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PARLIAMENT OF NEW SOUTH WALES

REPORT
OF THE
DEPARTMENT OF AGRICULTURE
FOR THE
Year ended 30 June, 1973

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14th March, 1974.

The Hon. G. R. CRAWFORD, D.C.M., M.L.A.,
Minister for Agriculture,
Sydney.

Sir,

I have the honour to present a report reviewing the activities of the Department of Agriculture for the year ended 30th June, 1973.

R. M. WATTS,
Director-General.

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ORGANIZATIONAL CHART

SENIOR ADMINISTRATIVE PERSONNEL

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- 3.1 RESEARCH ADMINISTRATION
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NOTE

In section 1 of this report some production and livestock figures are quoted as preliminary estimates – the best data available at the time that the report was compiled. In some cases final statistics will be available at a later date from publications of the Bureau of Census and Statistics.

Department of Agriculture N.S.W.



SENIOR ADMINISTRATIVE PERSONNEL

As at 30th June, 1973

Minister	Hon. G. R. CRAWFORD, M.L.A.
Director-General	R. M. WATTS
Senior Deputy Director-General	Dr F. C. BUTLER
Deputy Director-General	B. OWEN FRENCH
Assistant Director-General	Dr R. B. DUN
Secretary	J. L. HAGER
Assistant Secretary (Acting)	A. B. HERMANN
Accountant	E. A. BRAGG

Chiefs of Divisions:

Animal Industry	R. A. HALL
Dairying	Dr. G. J. SMITH
Horticulture	G. R. GREGORY
Plant Industry	L. R. KAVANAGH
Marketing and Economics	D. E. MACCALLUM
Extension Services	B. D. AMENT
Research Services	K. E. HUTTON

Executive Officer (Agricultural Education) J. E. JESSUP

Principals, Colleges of Advanced Education:

Hawkesbury Agricultural College	Dr F. G. SWAIN
Orange Agricultural College	A. J. MACKENZIE
Wagga Agricultural College	B. F. ATKINS

Chief Biometrician	E. A. ROBERTS
Director, Biological and Chemical Research Institute	T. H. JOHNS
Director and Chief Botanist, Royal Botanic Gardens and National Herbarium	Dr L. A. S. JOHNSON

1. THE RURAL INDUSTRIES OF NEW SOUTH WALES 1972-3

THE INDUSTRIES

WHEAT

Acreage and Production

Preliminary figures for the 1972–3 season indicate that 2 526 000 ha of wheat were sown for a production of 1 965 000 tonnes at an average yield of 0.8 tonne per ha. The area was lower than farmers originally intended because of the dry autumn, and the yield per hectare was lower than average because of late sowings in many areas and the dry spring. Although wheat delivery quotas were raised above the figures for the previous 3 years, production was the lowest since the 1965–6 season. Deliveries to the Wheat Board in N.S.W. totalled about 1 432 000 tonnes.

Official quality standards, determined on the Schopper scale, and production for the 1972–3 harvest were determined in metric terms for the first time and are as follows:

<i>Grade</i>	<i>kg per hectolitre</i>	<i>Approx. totals (tonnes)</i>
N.S.W. Prime Hard (Nos. 1 and 2 combined)	78	105 601
N.S.W. Prime Hard No. 3	77	44 838
Northern Hard	—	8 680
N.S.W. Southern Hard (Falcon/Eagle)	81.5	211 570
Northern F.A.Q.	—	911 908
Southern and Western F.A.Q.	80.5	911 908
Durum	—	7 274
Soft biscuit wheat	—	30 759
Off Grade	—	120 827

The northern wheat grades were lower in bushel weight than in the previous season while the southern grades were higher.

Premium Wheats

Local flour millers paid premiums direct to growers totalling \$111,011 on 36 870 tonnes of selected varieties of wheat grown in the 1972–3 season. Some interesting features were:

- Millers paid premiums totalling \$35,878 on 6 223 tonnes of hard varieties, at an average of \$5.42 per tonne.
- Soft (biscuit) varieties commanded a total premium of \$75,132 on 30 247 tonnes, at an average of \$2.48 per tonne.
- The variety Timgalen comprised by far the greatest part of the hard premium receivals, and Pinnacle by far the greatest part of the soft premium receivals.

Popularity of Wheat Varieties

Variety statistics for the 1971–2 season (the latest season for which figures are available) show that Timgalen (16.3 per cent) was the most popular variety, displacing Heron (15.8 per cent) which held first place for the previous eight seasons. Because of the increased emphasis on hard wheat production in central and southern areas, Falcon (13.3 per cent) and its derivative Eagle (3.1 per cent) increased in percentage area. The comparatively new northern variety Gatcher (6.4 per cent) is finding ready acceptance mainly at the expense of Gamut. Of other varieties, Olympic and Robin increased in percentage area in 1971–2, while Gamenya declined further in popularity.

Wheat Variety Recommendations

Teal, a new variety bred at Temora in the Wagga Agricultural Research Institute breeding program, was added to recommendations in most parts of central and southern N.S.W. Olympic will eventually be deleted from recommendations. Teal is superior to Olympic in straw strength, ease of threshing, resistance to flag smut and *Septoria tritici*, protein content and baking quality. Tarsa was recommended for a larger part of the Western Region, and Olympic was deleted from recommendations for the southern part of the North Western Region because of high susceptibility to stem rust.

Durum Wheats

Due mainly to the lateness of opening rains, the area sown to durum wheats reached only about 8 800 ha, compared to 12 800 ha the previous season. Production for the 1972–3 season was estimated at 8 000 tonnes, all of which commanded a premium. Evolution of the departmental durum wheat varieties Dural and the more recent Duramba, and interest by the Australian Wheat Board in this type of wheat, has opened up the possibility of expanded future export markets for durum wheats. Exports commenced in 1969 with a shipment to Kuwait, and have continued. A special delivery quota of 54 000 tonnes of durum wheat was allocated to New South Wales for both the 1971 and 1972 sowing seasons. The Wheat Board has arranged for continuing controlled production of durum wheats in northern N.S.W.

Southern Hard Wheat Segregation

Segregation of the hard bread wheat varieties Falcon and Eagle, at protein levels of 12 per cent and better, was extended during 1972–3. This type of wheat was segregated at sixty-four stations in central and southern areas, as compared with fifty-nine stations in 1971–2 and twenty-six in 1970–1. During the year 210 493 tonnes of Falcon/Eagle were segregated at an average protein content of 13.46 per cent. As at 23.7.73, 85 000 tonnes had been shipped overseas and 24 000 tonnes sold to local mills. Negotiations were at an advanced stage for the sale of a further 40 600 tonnes for export and 16 000 tonnes for domestic stock feeding purposes.

Weeds and Diseases

The most important weeds of wheat were skeleton weed (*Chondrilla juncea*), Wimmera ryegrass (*Lolium rigidum*) and wild oats (*Avena* spp.). Skeleton weed rust (*Puccinia chondrillina*), introduced by CSIRO as a biological control agent, had a definite controlling effect in southern areas, but not in northern N.S.W.

The dry season reduced the incidence and severity of disease, and losses in yield were mostly restricted to irrigation crops. As in 1971–2, septoria (*Septoria tritici*) was important in southern irrigation areas where moderate to heavy losses were reported from several districts. Stem rust (*Puccinia graminis tritici*) was common in southern and central areas but generally occurred too late to cause serious losses. In some southern irrigation districts, however, earlier infections occurred and moderate to heavy losses were experienced.

Frost damage caused moderate to heavy losses in individual crops in some central and southern areas.

OATS

Oat production in 1972–3 was estimated at 170 000 tonnes, well below the 217 000 tonnes of the previous season and the 449 000 tonnes harvested in 1970–1. Total sowings for all purposes were estimated at 440 000 ha, of which 240 000 ha were harvested for grain at an average yield of 0.7 tonne per ha. The area sown to oats in 1972–3 was the smallest for over ten years mainly because of the dry autumn, and the yield per hectare was well below average because of the dry spring. Rusts (*Puccinia coronata* and *P. graminis avenae*) were widespread, generally as light infections, in many crops. Overall losses were small, but some individual crops were severely affected.

Cooba, the leading variety since 1965–6, occupied 39.8 per cent of the total area in 1971–2. Coolabah increased its percentage area by about half and is now in second place with 15 per cent of the sown area. Avon declined slightly in percentage area from 13.7 to 12.8 per cent, dropping to third place. Of other varieties, Algerian increased and Belar, Fulmark, Fulghum and Bundy decreased.

Changes in variety recommendations for the 1972–3 season included withdrawal of Acacia for grain in the eastern section of the Western Region, and of Bundy from midseason sowings for grazing and grain in the Southern Region. Saia was added to and Cooba deleted from recommendations for late grazing on the Central and South Coast. Algerian was substituted for Cooba for grazing and hay in the same area.

BARLEY

Total sowings of barley in 1972–3 for all purposes were estimated at 400 000 ha, a slight decrease on the record area of the previous season. Production was estimated at 297 000 tonnes, a decrease from

that of the two previous seasons mainly caused by adverse seasonal conditions. The yield of 0.9 tonne per ha was lower than the average for the previous ten years.

Clipper displaced Abyssinian as the leading variety in the State in 1971–2, with nearly one quarter of the total area. This is a very rapid rise for a variety released in South Australia only 3 years previously. Abyssinian, the leading variety for many years, occupied 20.3 per cent of the total area. The only other major varieties were Research with 15.9 per cent, a slight increase over the previous season, and Prior with 11.7 per cent, a large decrease. Three varieties, Prior, Noyep and Proctor, were deleted from recommendations. No new varieties were added.

RYE

The latest available production statistics are for the 1971–2 season when 10 400 ha of rye were sown, a smaller area than for the previous two seasons. Grain production was 5 000 tonnes, about a third less than for the previous season, from a harvested area of 6 800 ha; giving an average yield of 0.7 tonne per ha, which is only slightly less than average. It is thought that both acreage sown and production of rye in 1972–3 declined still further.

RICE

The 1972–3 rice season was favourable in all districts and yields were high. The harvest was marred only by rain when it was 85 per cent complete. Millouts in 1973 are expected to be satisfactory and on a par with those of 1972.

Increased areas were permitted on some farms by the Water Conservation and Irrigation Commission of N.S.W. The area sown was estimated at 39 000 ha and production at 298 000 tonnes of paddy, giving an estimated average yield of 7.6 tonnes per ha. The 1971–2 figures were: area 36 736 ha, production 237 000 tonnes, and average yield 6.4 tonnes per ha. Calrose was the most popular variety with Kulu in second place.

Production in 1972–3 was estimated at 129 087 tonnes from the Murrumbidgee Irrigation Area, 68 266 tonnes from Coleambally, and 100 348 tonnes from the Murray Valley. These represented increases over the previous year of 33, 34 and 12 per cent for the respective centres.

The increase in production of long grained rice continued, and was assisted by the release of two new long grained departmental varieties, Baru and Inga. Incentive bonus payments were used by the Rice Marketing Board to encourage production of the long grained types to meet specific market requirements.

An extension campaign aimed at managerial and chemical control of barnyard grass (*Echinochloa* spp.) and rice sedge (*Cyperus difformis*) was successful and helped to ensure high yields of rice.

The incidence of bloodworm (*Chironomus tepperi*) in rice was at a reduced level in general but some untreated, late sown crops were severely affected.

MAIZE

Acreage and Production

The area of maize, estimated at 27 000 ha for the 1972–3 season, was 25 per cent below the average for the previous three seasons. This year, 52 per cent was grown in coastal districts and 43 per cent under irrigation in inland districts. Production was estimated at 90 000 tonnes, the lowest since 1968–9 and about 30 per cent below that of 1971–2.

Average yield was estimated at 4.4 tonnes per ha from irrigated crops and 2.9 tonnes per ha from dryland crops, 99 per cent of the area being sown to yellow dent hybrids. A small area of waxy maize was grown under contract, some for a Sydney manufacturer and some for export to Japan. Competition from other crops reduced the inland irrigated area, while adverse sowing conditions affected the coastal area.

Severe heat in early summer caused moisture stress. Heavy *Heliothis* damage occurred in some inland crops. Late summer rains on the north coast resulted in development of northern leaf blight (*Drechslera turcica*) and, for the first time in N.S.W., southern leaf blight (*D. maydis*). These diseases greatly reduced yields in susceptible hybrids, leading to grain prices as high as \$60 per tonne on farm. Sydney based manufacturers found difficulty in obtaining requirements, and imported large quantities from southern Queensland. The severe, often total, losses caused by *D. maydis* would have been avoided if growers had been able to follow the Departmental recommendation to avoid seed based on Texas cytoplasm.

Popularity Trends of Hybrids

The semi-dwarf early maturing hybrids were most popular in inland irrigated areas, and additional producers began harvesting them with open front headers. Hybrids XL45, XL307, XL361, XL81,

DK805a, PX50, PX52, PQ300, PQ301, NES1002, NEH1151, NEH1215wx, and H77 occupied most of the inland maize area, while GH390 and GH128 maintained their popularity on the coast. The new departmental hybrid GH390 replaced GH128 as the most popular hybrid.

Weed Control and Minor Element Deficiencies

The herbicides atrazine and 2,4-D were used on about 25 per cent of the crop with satisfactory results.

Molybdenum deficiencies continued to show up in some coastal crops and the application of zinc was required on some irrigated soils. Nitrogen and phosphorus deficiencies have also been reported.

SWEET CORN

Of the sweet corn area of about 2 060 ha, 96 per cent was grown under contract to processors for canning or quick freezing. Late spring and early summer were hot and dry. The incidence of *Heliothis* was the worst on record and resisted repeated control efforts. Average yields were lower than normal and varied from 6 to 10.25 tonnes per ha. The hybrids NK195, Lochief and Code 22 occupied most of the area sown for processing.

POPCORN

The area of popcorn grown under contract declined to about 50 ha for a production of approximately 100 tonnes. Production was largely confined to the Mudjee district with a small area on the New England tableland.

GRAIN SORGHUM

For the third year in succession a dry winter limited wheat sowings in the northwest, and resulted in an increased area being sown to grain sorghum. This was estimated at 260 000 ha, an increase of 10 per cent on the record area of 1971-2.

Good early seasonal conditions were followed by an extended period of severe heat and moisture stress which led to a 30 per cent reduction in the area harvested for grain. Late summer and autumn rain induced second growth in crops and prolonged the harvest into the winter. Production was estimated at 300 000 tonnes, a 20 per cent reduction on the 1971-2 harvest.

The area irrigated was estimated at 28 000 ha, from which an estimated average yield of 4 tonnes per ha was harvested. The average for dryland crops harvested was about 1 tonne per ha. The world wide shortage of feed grains resulted in higher than normal export prices. The Sorghum Marketing Board exported about 60 per cent of the crop.

There was a large increase in local demand for sorghum to meet the expanding needs of the livestock industries, particularly for lot feeding of cattle.

New hybrids and new seed producing companies continued to appear. Thirty different hybrids were offered to growers, seven more than in 1971-2. Hybrids in the early and mid-season maturity groups generally performed best in all districts.

The trend towards early sowing was encouraged and late spring rains enabled this practice to be undertaken on an increasing scale.

Mosaic disease was not as prevalent as in the 1971-2 season and caused little yield reduction. Stalk rots (*Fusarium* spp.) and charcoal rot (*Macrophomina phaseolina*) causing lodging and yield loss in some late maturing crops.

Sorghum midge (*Contarinia sorghicola*) was curtailed by dry early summer conditions but heavy damage occurred in some late maturing crops. Corn earworm (*Heliothis armigera*) was more evident in sorghum crops than in previous seasons, and some crops were aerially sprayed for control.

FORAGE SORGHUM

An estimated 40 000 ha of forage sorghum were sown, 90 per cent with hybrid seed, the remainder being Piper Sudan grass and the sweet sorghum varieties, Saccaline, Early Orange and Sugardrip.

BROOM MILLET

The area harvested was estimated at 520 ha, 70 ha more than in 1971-2. Production was estimated at 460 tonnes, an increase of 50 per cent on the previous season. Production was largely confined to the Tumut and Lismore districts. Fibre quality was the best for some years. Buyers from the eastern states paid up to \$550 per tonne for millet, which was about \$50 above the top price paid in 1971-2.

The tall growing locally adapted variety White Italian was the only one used. The hand harvesting necessary with the crop created labour problems and restricted grower interest.

FORAGE AND GRAIN MILLETS

Forage millets were preferred to sorghums by an increasing number of growers because of their safety for grazing cattle. Approximately 25 000 ha were planted for forage and grain. The varieties Japanese, Siberian, Hybrid MX001 and Tamworth Pearl were most popular for grazing.

The area planted for grain was reduced to about 4 000 ha, mainly in the north west. The season was adverse, grain production was very light, and prices offered were higher than normal. Grain production was confined mostly to varieties White French and Hungarian for use in the bird seed trade.

LEGUMINOUS CROPS

Cowpeas

Approximately 9 000 ha were sown to cowpeas, 3 000 ha on the coast for grazing, and 6 000 ha inland of which 50 per cent was harvested for grain for an average yield of about 300 kg per ha. Only two varieties, Caloona and Poona were used. Root and stem rot disease was a major problem in coastal districts.

Mung Beans

An estimated area of 1 900 ha was grown, mostly in the Inverell/Moree districts. Yields up to 1 tonne per ha were obtained with an average of about 400 kg per ha. A new large grained variety, Berken, was released by the Department and replaced some of the area previously sown to the small grained variety Celera. There was an increased local interest in the mung bean for sprouting. Growers received about \$105 per tonne on farm.

Lupins

Interest in sweet lupins declined to the extent that only about 600 ha were grown, mainly in the Wagga/Cootamundra area. Following a poor season, the top yield was about 700 kg per ha. Varieties Uniwhite and Uniharvest were grown commercially. The earlier maturing variety Unicrop was grown experimentally, and performed satisfactorily under the adverse seasonal conditions.

Field Peas

Only about 500 ha of field peas were grown, also in the Wagga/Cootamundra area. The varieties Early Dun and Derrimut were the only ones used. Yield of crops harvested ranged from 700 kg to 1.5 tonnes per ha but some areas failed because of dry spring conditions.

COTTON

A record 32 100 ha of cotton were sown in N.S.W. in 1972–3. Production is estimated at 103 000 bales for an average yield of 3.21 bales per ha. The crop made good growth throughout the season and under generally favourable picking conditions the harvest was 95 per cent complete by the end of June.

Fibre quality was good, most cotton achieving grades of middling plus. Micronaire values were 4.0 to 4.5 and Pressley strengths 80 000 to 82 000. At the end of June, 1973, Australian cotton prices were about 30 per cent higher than six months previously, reflecting record world prices.

In the Namoi Valley, 24 300 ha produced 77 700 bales at an estimated average yield of 3.2 bales per ha. About 22 700 bales were picked from the 7 300 ha sown in the Macquarie Valley for an average yield of 3.1 bales per ha. At Bourke 500 ha yielded 5.4 bales per ha. Only about 30 ha were sown in southern N.S.W.

During early 1973 a build up of *Heliothis* sp. reached plague proportions and caused heavy crop losses. The Namoi Valley was worst affected. Individual growers picked as little as 1.2 bales per ha, although those who achieved better insect control harvested up to 5.6 bales per ha. Factors contributing to the insect build up were: weather that favoured reproduction and growth of insects, but prevented timely application of sprays; the presence of *Heliothis armigera* as the dominant *Heliothis* species in cotton for the first time; and resistance to DDT exhibited by *H. armigera*. Rough bollworm (*Earias* spp.), cotton looper (*Anomis flava*), and red spider (*Tetranychus* spp.) appeared late in the season.

The humid conditions also favoured the development of bacterial blight (*Xanthomonas malvacearum*), and a loss of 0.37 bales per ha was attributed to this disease in the Namoi Valley. In addition to production losses, estimated at no less than 80 000 bales, growers incurred additional costs for insecticides and their application. At the height of the *Heliothis* infestation, spraying occurred every 3 to 4 days.

Deltapine 16 replaced Deltapine Smoothleaf as the most popular variety. Together they occupied 95 per cent of the area. Other varieties sown included Hopicala and Riverina Poplar. About 1 000 ha of narrow

row cotton were again planted in the Macquarie Valley. Despite improved harvesting equipment, the supposed advantages of narrow row culture were not confirmed.

The low yields, following upon the extremely low yields of 1971, combined with the high costs involved in attempting to control pests, have seriously damaged the industry's stability and confidence. In spite of record high prices ruling for raw cotton at the conclusion of the harvest, grower returns in most instances were nil to very low.

LINSEED

Linseed sowings in 1972-3 were estimated at 4 800 ha, a reduction of almost 50 per cent on the previous year. Production was about 2 600 tonnes at an average yield of 0.54 tonnes per ha.

The most important growing areas were the Central West and the North West Plains; about 15 per cent of the crop was irrigated. Contracts to purchase linseed were readily available, but sowings were restricted in all areas by dry weather, which also restricted yields in dryland crops. Crops considered to have satisfactory yield potential were sprayed to control *Heliothis*, which was the only pest of significance.

Crushers paid \$110 per long ton Sydney for seed with 38.5 to 39.5 per cent oil. Demand exceeded production and linseed was imported from overseas.

RAPESEED

It is estimated that 10 500 ha of rapeseed were shown in 1972-3. Production was 4 500 tonnes, compared with 16 932 tonnes from 33 021 ha in 1971-2. Poor seasonal conditions, especially in the southern and central tablelands, and increased wheat quotas, reduced sowings.

The most successful crops were in the southern slopes and Riverina, where over 30 per cent of the total area was sown. In favoured areas crops yielded up to 1.5 tonnes per ha. However the state average was only 0.4 tonne per ha. Adverse spring conditions, particularly in the central west, caused crops to be abandoned. On the tablelands most were grazed off during the dry summer. About 10 per cent of the area was irrigated.

Target and Oro (both *Brassica napus*) were the most widely sown varieties. The *B. campestris* cultivar Arlo was also grown. Disease losses were light, although isolated crops were seriously affected by blackleg (*Leptosphaeria maculans*). Aphids, which were the only insects to affect crops, were sprayed where crop potential warranted.

From samples received for diagnostic purposes it appears that nitrogen deficiency and manganese toxicity are quite common in rape throughout the State.

Seed was purchased at a contract price of \$93 per tonne Sydney for the low erucic acid variety Oro, and \$89 per tonne for other varieties. No seed was exported.

SAFFLOWER

It is estimated that the 4 000 ha of safflower sown in N.S.W. in 1972-3 yielded 1 200 tonnes of seed. In 1971-2, 10 592 tonnes were harvested from 18 675 ha. The largest sowings were made in the Dubbo-Coonamble area, but due to adverse seasonal conditions few crops were harvested.

The most significant production area in 1972-3 was around Menindee where safflower was sown into drying lake beds along the Darling River from August to November. Over 1 000 ha were sown, of which 560 ha were at Lake Tandou. Waterlogged conditions caused by summer storms led to losses from root-rot (*Phytophthora drechsleri*). Total production from the area is not known but yields per ha varied considerably.

A Sydney based crusher paid \$104 per tonne Sydney. Seed and oil were imported from overseas to meet the N.S.W. demand.

SOYBEANS

Soybean production in 1972-3 was a record for the fifth successive year, with about 10 000 tonnes harvested from 6 100 ha at an average yield of 1.65 tonnes per ha. In 1971-2, 6 167 tonnes were harvested from 3 698 ha. The Namoi, Gwydir and Macquarie River Valleys were the main production areas, and only 5 per cent of the crop was not irrigated. Yields of up to 3 tonnes per ha were achieved. Bragg, Lee, Hill, Wayne, Bethel, Clark 63 and Delmar were the most widely grown varieties.

Generally, the season for soybeans throughout the State was good. Late in the season, however, an unknown condition occurred in the north western soybean area. Losses in yield were difficult to estimate but at least one crop was a total loss. Investigations into the cause and nature of this condition are being carried out. *Heliothis* caused limited damage, as did green vegetable bug (*Nezara viridula*).

The market for soybeans was extremely buoyant, local crushers paying up to \$150 per tonne on-farm. Up to \$190 per tonne was paid for the yellow hilum-yellow seeded variety Delmar, which was in demand for export to Asia.

SUNFLOWER

The area of oilseed sunflowers fell by 60 per cent in 1972–3 to an estimated 105 000 ha. Estimates of production vary between 30 000 and 35 000 tonnes with an average yield of 0.3 to 0.35 tonne per ha. In the previous year, 121 024 tonnes were produced from 238 870 ha, about 0.5 tonne per ha. All seed sown originated from varieties introduced from Eastern Europe. Hybrid sunflower parent material was still under quarantine in June, 1973.

Approximately 70 per cent of the crop was sown in the northern parts of the State. Sowings took place from August to mid-March and 75 per cent of the crop was planted by the end of November. Moisture stress and heatwave conditions in December/January seriously reduced yields. Harvesting began in late December and was 90 per cent complete by the end of May. Seed quality varied but later crops and those sown in cooler districts generally had the highest oil percentage. Less than 10 per cent of the crop was irrigated. Poor management, weed competition and uneven plant stands contributed to the low average irrigated yield estimated at 1.3 tonnes per ha. Nevertheless, yields up to 2.5 tonnes per ha were reported.

The diseases white blister rust (*Albugo tragopogonis*), red rust (*Puccinia helianthi*), and head rots (*Rhizopus* spp.) were evident, but did not seriously affect yields. On the Northern Tablelands significant loss occurred in some crops through head drop, caused by boron deficiency. Rutherglen bug (*Nysius vinitor*) and *Heliothis* were active in all areas and contributed to low yields. Few crops were sprayed.

A shortage of vegetable oilseeds throughout the world resulted in prices for sunflower seed increasing as the season progressed. Growers received up to \$135 per tonne on-farm for seed yielding 42 per cent oil.

MINOR CROPS

Peanuts

It is estimated that 340 ha were planted in 1972–3 producing 500 tonnes. Following a successful trial in 1971–2, approximately 120 ha were grown under irrigation near Wee Waa. A further 70 ha were grown dryland near Bundarra on the North West Slopes. The remainder of the crop was grown in the traditional production area on the Far North Coast. Peanut mottle virus, first reported in Queensland in 1966, was found during the year at Wee Waa. The disease was widespread but did not cause significant losses.

Buckwheat

Trading companies continued to seek buckwheat seed for the Japanese market. Only small areas were sown, however, due to dry conditions in tableland districts. Trial plantings at Bathurst and Armidale were promising, in spite of the unsatisfactory season.

Kenaf

Growers at Moree, Warren and Jerilderie continued to experiment with kenaf. Samples of material have been forwarded to Japan for paper pulp evaluation.

TOBACCO

The area of tobacco was reduced by 32 per cent to 869 ha in 1972–3 as the result of the carryover of 450 000 kg of leaf from the 1972 harvest. Average yield was estimated at 1 400 kg per ha and production at 1.2 million kg. This production on top of the 1971–2 carryover caused a further surplus of 260 000 kg above the N.S.W. marketing quota of 1 386 631 kg.

Most of the crop was grown in the Ashford–Inverell area, with small plantings at Tamworth in southern N.S.W. and on the North Coast. The most widely grown variety was Q46. Burley tobacco was produced by at least four growers.

Leaf quality was generally satisfactory, though it was sometimes adversely affected by harsh conditions or by excessive applications of nitrogen. The introduction of plant position sorting and loose leaf selling allowed leaf to be graded more rapidly than in the past.

Blue mould (*Peronospora tabacina*), brown stem rot (*Phytophthora nicotianae* var. *parasitica*) and tobacco mosaic virus were evident but losses were not serious. Growers were able to control *Heliothis* and leaf miners (*Phthorimaea operculella*). Tobacco beetle (*Lasioderma serricorne*) in stored leaf, carried over from the 1972 harvest, had to be controlled on many farms.

VEGETABLES

Asparagus

Another good season was experienced by asparagus growers and processors. In Central Western districts, where the area increased by about 12 per cent to an estimated 1 350 ha, yields in excess of 4 tonnes per ha were obtained. The State area for 1971–2, the latest year for which figures are available, was 1 623 ha (1 525 in 1970–1). All areas reported some difficulty in securing skilled labour for harvesting. Main areas of production continued to be Bathurst, Cowra, Gundagai, Mudgee and Dubbo, processing being undertaken at the three first-mentioned centres.

Copper was among many deficiencies reported from asparagus grown on the poor sandy soils at Speers Point near Kempsey. Although a common deficiency of citrus in years gone by, copper is now a very unusual deficiency in N.S.W. as it is automatically corrected on the coast with Bordeaux sprays.

Beans

The area devoted to green beans for the fresh market continued to decline in most districts. Offsetting this decline was an increase in the area sown for processing. Wet weather and flooding in the Clarence River valley reduced the total State area to less than the 2 269 ha sown in 1971–2.

Interest in the production of edible dry beans, mainly field beans, slackened in the Macquarie Valley and on the Northern Tablelands. This was due to the poor results obtained in 1971–2 as a consequence of wet weather on the Northern Tablelands, inexperience with the crop under irrigation in the Macquarie Valley, and lack of suitable harvesting equipment in both areas. Despite these difficulties the crop still has considerable potential.

Summer death disease was not seen outside departmental trial plots, as resistant green and dry edible beans are now widely grown commercially.

Carrots

Area and production for 1972–3 are estimated to be similar to 1971–2 when 1 012 ha produced 26 779 tonnes. Production in market gardens continued to decline and was offset by increased production in the Murrumbidgee Irrigation Areas (M.I.A.) and the Singleton district. In both these areas the crop is grown on a more extensive scale, using mechanical harvesters and washing facilities, and many of the carrots are prepacked.

Cole Crops

In line with demand patterns, there was a slight increase in the area of cabbage and a slight decline in the area of cauliflower. Areas planted in 1971–2 were 633 ha of cabbage and 777 ha of cauliflower. Demand for Brussels sprouts remained firm and was met mainly by supplies from Victoria. Opportunities for production of this crop have not been exploited by N.S.W. farmers. Interest in and demand for sprouting broccoli continued to increase. Production was mainly in the Hawkesbury Valley and the Bathurst and Dubbo districts.

Hot weather in December and January followed by excessive rain and humidity in February led to overall shortages in supply, with prices reaching record levels. A greater proportion of the cauliflower crop was marketed either in cartons or bulk bins and in a fully or partly trimmed condition. This resulted in handling economies and in less leaf litter in the markets.

The trend towards direct seeding and the use of herbicides for weed control continued, especially with cabbage. Seed of cabbage and cauliflower was produced in the Griffith district for both local and export markets.

Clubroot was widespread in crops in the Hawkesbury Valley. Turnip mosaic virus was widespread in autumn at Maitland causing serious economic losses in hybrid cabbage crops.

Lettuce

Plantings were about the same as the previous year when the area was 719 ha. Difficult seasonal conditions from January to March reduced supplies and prices rose to very high levels. Virus diseases were worse than usual. Production in market gardens showed a slight decline, but was offset by increased plantings in areas a little more distant from Sydney. The area planted near Wentworth (for supply to Melbourne) also increased. Seed was again produced near Griffith for both domestic and export markets.

Onions

The area planted was about the same as in 1971–2 when 833 ha were grown. However, yields per unit area were estimated to be lower because seasonal conditions were not quite as favourable. Production was again centred on the M.I.A. with lesser areas near Finley and Gunnedah. Exports, chiefly to Japan, South East Asia and Pacific markets, were substantially less than from the previous crop. Prices on the domestic market were generally higher than in recent years.

Peas

Production of this crop both for the fresh market and processing, showed a further decline on the 1971–2 figures when a total of 3 562 ha were planted. Imports of processed peas from the southern states and New Zealand satisfied the major part of the demand.

Potatoes

Plantings for 1972–3 were about 10 per cent less than in 1971–2 when 10 202 ha were grown. The drop in area was a reaction to the uneconomic prices received in the previous year. Yields were about average but market prices were the best for many years because of reduced supplies from interstate.

Seasonal conditions varied substantially from district to district and were best at Dorriggo and in the eastern section of the Northern Tablelands. Fairly dry conditions prevailed on the Central and Southern Tablelands, particularly during the autumn months. Early frosts also occurred in those areas.

The proportion of the crop processed in one form or another again increased, crisps and frozen fries being predominant. Towards the end of the year crisps manufacturers were having difficulty in securing supplies of potatoes that would make a standard quality product. Washed potatoes continued to increase in popularity, while the quantity prepacked also increased. Complaints concerning greening were received at regular intervals and appear to have been related to the popularity of washed potatoes packed in clear plastic bags.

Rhizoctonia disease (*Rhizoctonia* spp.) occurred in potato crops throughout the State. The disease is reducing yields considerably in the Coleambally and Finley areas. Leaf roll virus continues to be a problem in the Orange-Millthorpe area. This virus also caused losses in the West Corugan, Nowra and Finley areas. Bacterial wilt (*Pseudomonas solanacearum*), a very destructive disease, is still persisting in the Ebor-Hernani area. Blackleg (*Erwinia atroseptica*) was a problem in the West Corugan, Orange, Maitland and Glen Innes areas. Target spot (*Alternaria solani*) caused widespread defoliation in crops as they reached maturity in autumn in the West Corugan, Windsor, Orange, Maitland and Guyra areas. Powdery scab (*Spongospora subterranea*) was recorded during the year in a small commercial planting at Mona Vale. This is the second record of the disease in the Sydney metropolitan area, the only previous record being at Rose Bay in 1933.

Tomatoes

The area planted to fresh market tomatoes was static in most districts, while the area of processing tomatoes increased. In the previous year the total area, including that under glass, was 2 611 ha. Results were generally satisfactory from the fresh market crop which is grown in coastal districts, although heavy rain and humid weather in February caused yield losses. The inland processing crop was not as fortunate. A heatwave in January took its toll and was followed by heavy rains in February which caused further losses. Coupled with a shortage of labour for harvesting the result was little short of disastrous at Mudgee and unsatisfactory at Cowra, Deniliquin, Griffith and Gunnedah. Processors were unable to secure even half their requirements. Market prices were generally satisfactory for coastal producers. Inland growers forwarded supplies of processing varieties to the Sydney market in an effort to recoup their losses. Public acceptance of these varieties was better than anticipated.

Plagues of thrips in the M.I.A. caused a severe infection of the virus disease spotted wilt. Spotted wilt caused severe losses in crops of canning tomatoes in the M.I.A. in spring and summer. Bacterial canker (*Corynebacterium michiganense*) caused serious losses in the metropolitan, Campbelltown and Lismore areas. Bacterial wilt (*Pseudomonas solanacearum*) was severe on the Far North Coast in plantings made between February and early May.

Miscellaneous Vegetables

The production of all other vegetables showed little change from previous years.

PASTURES

Area

The following table gives a picture of improved pasture trends in N.S.W. over the 3 years 1970 to 1972, the latest year for which figures are available.

Area of farms and various types of pasture in N.S.W.

	1970 (000 ha)	1971 (000 ha)	1972 (000 ha)
Alienated land	69 051	69 229	69 000
Unimproved land	58 538	58 913	57 902
Sown pasture	4 483	4 807	4 978
Lucerne	782	937	917
Topdressed natural pasture	1 418	1 316	798
Total improved pasture	6 683	7 060	6 693

It will be seen that while the area of sown pasture continued to rise even until the final year of the rural recession (1972) the area of lucerne dropped by about 2 per cent in that year. The area of topdressed natural pasture had commenced to decline as early as 1971 when a fall of 7 per cent occurred followed by a further decline of about 40 per cent in 1972.

Aerial Pasture Improvement

The following table shows a decline in all forms of aerial pasture improvement in 1971. This decline continued in 1972 for area topdressed and seeded and for tonnes of superphosphate dropped, but there was a surprising rise of 70 per cent in kg of seed dropped.

Aerial Pasture Improvement in N.S.W.

	1970	1971	1972
Area topdressing and seeded (000 ha)	2 459	1 865	1 461
Superphosphate dropped (000 tonnes)	298	211	182
Seed dropped (000 kg)	950	797	1 344

Weeds

Galvanized burr (*Bassia burchii*) continues to be the worst weed of native pastures in N.S.W. Successful control was carried out on the southern and eastern fringes of its infested area of about 2 000 000 hectares. Other important weeds of pastures are serrated tussock (*Nassella trichotoma*) and various types of thistles. Ecological methods have been used to control all of these weeds, e.g., spring sowing of phalaris was adopted by many tableland graziers to control thistles.

Pests and Diseases

Improved pastures on the North and Central Coast, especially those in which kikuyu was dominant and growing vigorously, were affected by caterpillars of pasture webworm, (*Psara licarsalis*), and lawn army worm, (*Spodoptera mauritia*), in the summer and autumn. Cattle were disinclined to graze infested pasture due to contamination by caterpillar excrement.

Root rot of subterranean clover was of minor importance in most districts because of dry seasonal conditions. Other diseases of subterranean clover were also less common than normal. Root-knot nematode remains a perennial problem on river flat country of the North Coast. Yellows (cause undetermined) was again present in lucerne stands during the summer-autumn period. The incidence appeared less than last year. A number of lucerne samples submitted for analysis were affected with molybdenum, potassium and boron deficiencies and manganese toxicity.

Pasture Seed Production

Although producers were generally more interested in pasture seed production this year because of a growing shortage of seed, climatic conditions were not favourable and total production was well below demand. Production of certified seed was 627 tonnes, compared with 520 tonnes in 1971–2.

Seed cleaning firms processed 996 tonnes of uncertified seed during the year (1 118 tonnes in 1971–2). Lucerne (*Medicago sativa*) 287 tonnes, subterranean clover (*Trifolium subterraneum*) 203 tonnes, carpet grass (*Axonopus affinis*) 180 tonnes and paspalum (*Paspalum dilatatum*) 133 tonnes were the principal species processed.

Improved circumstances in the pastoral industry together with a return to more favourable seasonal conditions in autumn 1973 led to a strong demand for seed of all pasture species. As a consequence seed is now in extremely short supply and is selling at unprecedented prices.

N.S.W. Herbage Plant Liaison Committee

This committee continued to play a significant role in the registration, release and seed multiplication of new herbage plant cultivars. The Committee during the year recommended the registration of joint vetch (*Aeschynomene falcate*) cv. Bargoo, and the release of kikuyu (*Pennisetum clandestinum*) cv. Breakwell, and Japanese lespedeza (*Lespedeza striata*) cv. Kaloe.

FODDER CONSERVATION

Fodder Reserves

Fodder reserves of hay, silage and feed grains held on farms at the 31st March, 1973 were estimated to be sufficient to provide a drought ration for 44 days for all sheep equivalents in the state. This is a reduction of some 28 per cent over the previous year.

Hay

Hay stocks in 1971–2 were some 1 783 600 tonnes and in 1972–3 it is estimated that 915 300 tonnes were made and that about 1 322 000 tonnes were fed, thus leaving stocks of about 1 376 900 tonnes. Following are estimates of production of the principal types of hay in 1972–3 (production for 1971–2 in parentheses):

Type of Hay	Production (est.) 000 tonnes	Price range per tonne
Lucerne	508.5 (655.7)	\$60–\$80
Pasture	254.2 (313.5)	\$50–\$70
Wheaten	76.3 (82.9)	\$30–\$60
Oaten	76.4 (97.5)	\$30–\$60

Prices for hay were largely nominal as only small quantities became available due to low production caused by a dry season.

Silage

It is estimated that silage stocks at 31.3.73 stood at 610 200 tonnes, some 17 per cent lower than the previous year. Silage fed in 1971–2 was a record 355 900 tonnes, and it is estimated that for 1972–3 it was 406 800 tonnes. Because of the large cattle population, silage is now being used as a production or supplementary feed rather than as a drought reserve.

Feed Grains

Total feed grain production (excluding wheat) was 1 202 700 tonnes (oat equivalents) in 1971–2 and 953 400 tonnes in 1972–3. Grain fed (including wheat) rose from 592 100 tonnes in 1971–2 to 635 600 tonnes in 1972–3.

Grain prices have been at record levels for most of the year as the following table indicates:

	1971-2 per tonne	1972-3 per tonne
Oats	\$23-\$30	\$36-\$62
Barley	\$26-\$30	\$30-\$47
Maize	\$35-\$49	\$33-\$69
Sorghum	\$25-\$32	\$28-\$44

IRRIGATION

Area and Developments

Statistics for 1971-2 (the latest available) reveal 709 000 ha under irrigated production, comprising 167 000 ha in irrigation areas, 309 000 ha in irrigation districts, and 233 000 ha from licensed diversions. This was an increase of 74 000 ha over the 1970-1 area. As in that year, the largest part of the rise resulted from licensed diversions which increased by 36 000 ha in 1971-2.

With the general improvement in the economics of the rural industries and in particular livestock, an increasing interest is being exhibited by primary producers in irrigated pastures and their integration with dryland grazing. This is particularly so in the Murrumbidgee, Lachlan and Macquarie Valleys. Pastures currently occupy about half the total N.S.W. irrigated area.

Storage of water has commenced at Copeton Dam, and if required, releases for irrigation can be made in 1973-4. Storage is presently available for 863 000 Ml of water. This figure will rise to 1 363 000 Ml on completion of the dam.

Underground Water Resources

The Water Conservation and Irrigation Commission is continuing to investigate the ground water potential of the alluvial formations of the State's major river valleys. Utilization for irrigation of known underground reserves in the Lachlan and Murrumbidgee Valleys is progressing slowly, but excellent prospects exist for future development in these areas.

Aquatic Weeds

Aquatic weeds continued to spread, notably alligator weed (*Alternanthera philoxeroides*), salvinia (*Salvinia auriculata*) and water hyacinth (*Eichhornia crassipes*). A working panel appointed by the Standing Committee on Agriculture investigated the water hyacinth infestation in the Gingham watercourse near Moree. Its recommendations that the infestation be contained and drainage of the area investigated were adopted by Standing Committee. The recommendations are being implemented.

CITRUS FRUITS

Seasonal Conditions and Production

Temperatures were mild in all districts until the summer months when heatwave conditions were recorded (maxima of 41°C at Gosford and 44°C at Dareton). Rainfall was near average in all districts but very uneven in seasonal distribution, with heavy falls in late summer and early autumn. This heavy rainfall kept Valencia oranges sizing on the M.I.A., resulting in a record 54 550 tonnes production in that area.

The final estimate of N.S.W. citrus production in 1972-3 was a record 219 770 tonnes main crop, plus 6 820 tonnes summer crop lemons and 2 390 second crop Valencias. The preliminary forecast for 1973-4 is for a lesser production of 172 730 tonnes. (For metric conversion, 44 bushels of citrus weigh 1 tonne.)

N.S.W. Citrus Production (tonnes)

	1972-3 Final Estimate	1973-4 Preliminary Forecast
Navels	56 820	48 410
Valencias	125 230	93 410
Commons	1 140	3 910
Sevilles	290	230
<i>Total oranges</i>	183 480	142 960

N.S.W. Citrus Production (tonnes) – continued

	<i>1972–3 Final Estimate</i>	<i>1973–4 Preliminary Forecast</i>
Lemons (winter crop)	20 840	16 590
Mandarins	8 630	7 500
Grapefruit	<u>6 820</u>	<u>5 680</u>
<i>Total main crop citrus</i>	219 770	172 730
Lemons (summer crop)	6 820	
Valencias (second crop)	<u>2 390</u>	
<i>Total production</i>	228 980	

Marketing

The trend to marketing citrus fruit in poly-net bags developed rapidly during the season, particularly on the M.I.A. where an estimated 75 per cent of the fresh citrus marketed was prepackaged in this manner. As a result, about 70 per cent of the fresh fruit from the M.I.A. bypassed the central markets. Sales and deliveries direct to retail chain stores have reduced marketing costs, but are creating a new form of marketing monopoly by large packing houses that could eventually weaken the overall marketing structure.

Despite the record citrus production, local market prices were maintained at reasonable levels for most of the season due to the high proportion of the crop diverted into processing. On the Lower Murray, 60 per cent of Valencias and 30 per cent of Navels were processed. The hot summer greatly increased consumption of citrus juices and carry-over stocks are minimal. The main growth field for processed products was in the chilled juice trade.

The export of 5 910 tonnes of oranges from N.S.W. was about 70 per cent of the 1971–2 level. The shipment of small oranges to Hong Kong was an interesting development in that these fruit are of low demand on the domestic market. An experimental shipment of 80 tonnes of frozen oranges was sent to Japan from Sunraysia (60 per cent of this district's citrus production is grown in N.S.W.). The export of lemons from coastal districts to the U.K. was encouraged by the Lemon Marketing Board of N.S.W. and 26 containers were shipped.

Planting Statistics

The N.S.W. fruit tree planting census at December, 1972, shows that the situation continues to be stable:

N.S.W. Citrus Plantings

	1971			1972		
	<i>Area (ha)</i>	<i>% Area Non- Bearing</i>	<i>Trees</i>	<i>Area (ha)</i>	<i>% Area Non- Bearing</i>	<i>Trees</i>
Oranges	10 962	13	3 025 217	10 846	12	3 009 711
Lemons	1 244	18	348 994	1 309	20	380 452
Mandarins	998	20	285 627	964	15	277 444
Grapefruit	322	34	93 064	392	41	118 446
Sevilles and others	23	21	6 268	23	21	6 163
Total citrus	13 549	14	3 759 170	13 534	14	3 792 216

The table shows a slight fall in total area but an increase in total tree numbers, illustrating the continued trend towards higher density plantings. There are now 279 trees to the hectare overall, and 341 trees to the hectare for non-bearing citrus. The per cent area of non-bearing citrus is static, but the distribution between types has changed with a drop in non-bearing orange and mandarin and an increase in lemon and grapefruit plantings.

Industry Organization

The organization of the N.S.W. citrus industry experienced some difficulties during 1972–3. The Lemon Marketing Board of N.S.W. and the Central Coast (N.S.W.) Citrus Marketing Board withdrew support from the N.S.W. Citrus Growers Council, long regarded as the senior State citrus organization. This deterioration in the co-operation between the organizations stemmed very largely from the defeat of two polls conducted under the Marketing of Primary Products Act. The first poll, to decide whether an additional area should be incorporated in the area controlled by the Central Coast (N.S.W.) Citrus Marketing Board, was narrowly defeated following an active campaign. The second poll, concerning the area controlled by the Citrus Fruits (excluding lemons) Marketing Board of Wentworth and part of Balranald Shires, did not receive sufficient votes for a count and is to be repolled in the near future. Success of the second poll, to encompass the whole N.S.W. Murray River area, is necessary to permit a co-operative marketing scheme under the Mildura and Districts Citrus Co-operative Society Limited, which will handle the affairs of both the Victorian and N.S.W. Boards of the Murray Valley region.

Industry Developments

In the second year of budcutting from the citrus bud multiplication block at the Dareton Horticultural Research Station, 58 000 buds were supplied to nurserymen through the N.S.W. Co-operative Bud Selection Society Limited. Demand was increased by publicity in the *Nurseryman* newsletter and the society has been complimented by nurserymen on the good quality of the budwood supplied.

Increasing numbers of citrus orchards in the Hawkesbury/Hills area are being subdivided for urban development, prices obtained for properties ranging up to \$30,000 per hectare.

The hedging of citrus groves by mechanical boom saws is rapidly gaining acceptance as a means of controlling tree size to reduce management and harvesting costs. The practice is best suited to hedgerows planted north-south for better light interception and improved fruit set. Knowledge of hedging from both research projects and grower practice is increasing, but there are many aspects requiring consideration to achieve a successful result. Timing and severity of hedging in relation to tree vigour and age are important considerations in achieving the right growth response for fruit set in the following year.

Pests and Diseases

Citrus leaf miner (*Phyllocnistis citrella*), first reported at Tweed Heads in July, 1971, was widespread in home gardens on the Far North Coast by autumn 1973, and occurred as far south as Kempsey. The economic importance of this insect, a pest of young foliage, has yet to be established.

The presence of Queensland fruit-fly (*Strumeta tryoni*) in the M.I.A. severely curtailed the movement of citrus to supply interstate and export markets.

Fruit from coastal areas sold in Sydney (and Brisbane) was generally of good appearance and internal quality, with only the occasional need to downgrade. With export lemons to the United Kingdom, however, there were a number of instances of fruit breaking down on arrival. There appears to be a need for main crop lemons to be harvested earlier, at the "Silver-green" stage of maturity, when intended for export to Europe.

The hot summer favoured the development of black spot (*Guignardia citricarpa*) and some heavy losses of Valencias resulted in coastal districts. On the Murrumbidgee and Murray Irrigation Areas, some puffing and creasing of the rind developed in both Navel and Valencia oranges, although major difficulties were overcome by the high proportion of the crop processed. Melanose (*Diaporthe citri*) infections caused considerable amounts of rind blemish on Valencia oranges and Eureka lemons.

Boron toxicity was diagnosed in the Griffith district. High boron in citrus occurred in conditions where there was nitrogen deficiency.

POME FRUITS

Seasonal Conditions and Production

Midsummer was most unfavourable in all districts with heatwave and dry conditions adversely affecting fruit development, particularly in early maturing varieties. At Bilpin, trees were subjected to severe stress and many Gravensteins ripened prematurely and fell. In the M.I.A. despite frequent irrigations, hot weather caused premature ripening of canning pears. Sunburn and drought marking of fruit were prevalent in most districts. Substantial rains during late summer caused the situation to improve dramatically and midseason/late maturing varieties considerably improved in size and quality.

Because of the generally warmer weather, most varieties matured one to two weeks earlier than usual. The season again emphasized the advantage to be gained from irrigation, even in traditionally "reliable" districts.

Hail damage was not as serious as in the previous few years except in the New England district. Only a negligible amount of fancy grade fruit was harvested in the whole of New England.

The apple crop was estimated to produce a record 104 225 tonnes, compared with the previous year's 83 925 tonnes. The pear crop was estimated to produce 20 425 tonnes, compared with the previous year's record of 21 750. (For metric conversion purposes, 55 bushels of apples or 44 bushels of pears have been regarded as the equivalent of 1 tonne.) Problems associated with satisfactory disposal of the heavy apple crop could occur.

Marketing

Because seasonal conditions caused apples to mature earlier in 1973, a dispensation was granted by the Minister allowing growers to commence harvesting Jonathan and Delicious varieties one week earlier than prescribed by the regulations.

Wholesale market prices for pome fruit ex-cool store during the latter half of 1972 were very attractive and significant premiums were secured for late stored controlled atmosphere (C.A.) fruit. Some Delicious and Granny Smith apples secured prices as high as \$11 and \$7 respectively per 20 kg package. This attracted the first supplies for many years of Granny Smith apples from Western Australia. Growers of early maturing apple varieties in coastal districts again experienced considerable competition from late stored C.A. fruit. Production of some of these early varieties is now largely uneconomical and further areas will be removed.

Prices for that part of the 1973 apple crop marketed to date can only be described as fair, probably due to the greater volume of fruit available.

Although statistics are unavailable, it appears that record quantities of apples were processed in N.S.W. in 1972 and a similar situation is likely in 1973. The most significant increase has occurred in the M.I.A. where 80 per cent of the 1973 apple crop has been processed.

Exports of apples from N.S.W. during 1972 amounted to 975 tonnes, appreciably below the previous 5-year average of 2 625 tonnes, and was due mainly to a light crop and some general loss of interest in export activities in the M.I.A., and hail damage elsewhere in the State. In 1973, apple exports from the M.I.A. of 400 tonnes are again well below the average of around 1 800 tonnes because of lack of confidence in the export market.

Despite considerable concern in the Australian pear canning industry during the past few years, more pears were canned in 1973 than the average of the previous 3 years.

Planting Statistics

The N.S.W. pome fruit tree planting statistics as at December, 1972, are as follows:

	<i>Hectares</i>		<i>Trees</i>	
	<u>No.</u>	<u>% Non-Bearing</u>	<u>No.</u>	<u>% Non-Bearing</u>
Apples	7 102	12	1 907 655	17
Pears	1 238	14	297 937	15

Between December, 1971, and December, 1972, total hectares planted to apples and pears decreased by 194 and 15 respectively. The major tree removals occurred in the Campbelltown and Armidale districts, whilst the few new plantings are mainly confined to Orange and Batlow. Since the Australian Government's Tree Pull Assistance Scheme was introduced in 1972, approval has been given for the removal of 132 hectares of apples and 50 hectares of pears.

Market preferences for varieties within N.S.W. have become well defined and growers are rationalizing plantings to meet current and anticipated demands. Since the development of C.A. storage, apple varieties like Rome Beauty, Democrat and Yates have declined in popularity and many of these trees have either been removed or reworked to more profitable varieties. Strains of Red Delicious apples are increasingly asserting market dominance and this has been by far the most planted apple variety and most popular choice when trees have been reworked. Similarly many Williams pear trees have been displaced by either Beurre Bosc or Packhams Triumph.

Industry Developments

Expansion of cool storage facilities appears to have slowed down, but interest in the relatively inexpensive method of converting regular storage rooms to C.A. storage using the plastic tent method is still attracting interest.

The trend to higher density plantings with semidwarf apple trees is now well established, e.g., at Batlow plantings averaged 410 trees per hectare in 1970, 672 in 1971, and 968 in 1972. Concurrent with this development is the considerable interest in the centre leader system of training apple trees. Both developments are expected to improve efficiency in production. Interest in higher density pear plantings is being hampered by the unavailability of suitable dwarfing rootstocks.

In 1971 and 1972, 2 250 and 1 925 tonnes respectively of pears were exported, compared with an average of 975 tonnes for the 5-year period ending 1970–1. About 70 per cent of the pears exported from N.S.W. go to Singapore. Most are produced in the Orange district from where 450, 1 250 and 1 725 tonnes were exported in 1971, 1972 and 1973 respectively.

In the New England district some growers have experienced hail damage for 4 years out of the past 5, and at one stage during the year more than forty growers had secured full employment away from their orchards.

Pests and Diseases

Two-spotted mite (*Tetranychus urticae*), a difficult pest to control in most seasons, caused considerable problems during the hot, dry midsummer period of 1972–3. The Department co-operated with CSIRO in releasing the introduced mite predator *Typhlodromus occidentalis* in commercial orchards at Batlow and Bathurst. The predator is very useful in U.S.A. and Canada, where its presence appreciably lowers the usual costs associated with mite control by chemicals, and it is hoped that it will establish satisfactorily in N.S.W. orchards.

Fruit-fly (*Strumeta tryoni*) was much more troublesome than usual. Usually, the control of this pest in pome fruits requires no major effort and losses are minimal. Infestations occurred in a number of districts and five lines of N.S.W. fruit and one from interstate were seized at the Sydney wholesale markets.

Flying foxes were prevalent in large numbers in the Bilpin district and caused heavy fruit losses. The irregular occurrence of this pest presents particular problems and there is no satisfactory method of control.

The fungus disease sooty blotch (*Gloeodes pomigena*), which is usually of minor significance, created problems for many growers in the Campbelltown, Armidale and Windsor districts. Its occurrence was associated with considerable pre-harvest rainfall. Dipping and rinsing fruit affected with sooty blotch appreciably increases handling costs.

STONE FRUITS

Seasonal Conditions

Dry conditions during the spring and early summer months retarded tree growth and fruit development in all non-irrigated areas, although late maturing varieties sized well following heavy falls of rain in January–February. Comparatively dry conditions were experienced in most areas during the main part of the harvesting period and minimal losses occurred from weather damage and rots.

Canning Fruits

With the clearing of stocks by the Leeton Co-operative Cannery, the canned deciduous fruit industry is temporarily in a better position than it was last year, although the long term viability of the industry is still in doubt due to uncertainties in the marketing situation and the adverse effects of changes in currency values.

The bearing area of apricots declined by 22 ha from 434 in 1971 to 412 in 1972, and that of peaches by 143 ha from 1 359 in 1971 to 1 216 in 1972.

Apricot production in 1972–3 was 6 569 tonnes, about the same as in 1971–2. There was an increase in the production of peaches from 20 270 tonnes in 1972 to 23 206 tonnes in 1973. The decline in bearing areas is caused by the operation of the Tree Pull Assistance Scheme, and also the reduced rate of replacement plantings in recent years.

With cannery payments still outstanding for a portion of the 1971–2 crops, many growers lost confidence in the industry and failed to give their orchards the attention normally provided. This resulted in a considerable loss of apricots and early peach varieties which failed to reach the required minimum size. The apricot crop was also severely affected by pit burn as a result of the heatwave and failure of some growers to irrigate.

Due to low prices offered for apricots for processing, some growers in the Yenda district sun-dried a portion of their crops. The weather remained favourable for this operation. Although labour costs for hand pitting were high, net returns from the dried product are expected to be slightly higher than the current canning grade price.

Dessert Peaches and Nectarines

Production of these crops is declining, mainly due to the loss of areas around Sydney to urban development. Production is increasing, however, from the yellow fleshed early dessert peach varieties introduced from overseas by the Department, and released to the industry over recent years. Supplies of early varieties, ripening before Christmas, were insufficient to meet market demand and a similar

situation occurred in February. Ample supplies were available in the early January period. The practice of post-harvest dipping of fruit in fungicidal preparations was widely adopted through the season and resulted in a very significant reduction in the incidence of fruit rotting in the markets and retail stores. The treatments used were those developed and recommended by the Department as a result of research conducted at Bathurst Agricultural Research Station.

Cherries

Statistics showed a slight increase in the bearing area of cherries from 1 409 hectares in 1971 to 1 456 in 1972. There was a record production of 2 350 tonnes at Young despite small fruit size and losses that occurred from the drought conditions that prevailed during the spring and early summer. (For metric conversion purposes, 46 bushels of cherries have been regarded as the equivalent of 1 tonne). A moderately heavy crop of 2 174 tonnes was reported from Orange, where weather was favourable during harvesting and losses from hail and rain were small. Brining operations increased at Orange where the local brinery accepted 386 tonnes of fruit for processing, and a small quantity of fruit was brined at Young. A decision of the Australian Government, based on a Tariff Board inquiry, to reduce and finally remove duties on the importation of processed cherries has caused concern in the industry. Exports of cherries to Pacific Island markets and to Hong Kong and Singapore increased during the year, and token consignments to test marketing potentials were forwarded to Great Britain, Europe and North American markets.

Prunes

Dry weather adversely affected prune production at Young while crops in the M.I.A. were reduced by approximately 30 per cent due to sun-scalding during the January heatwave. A large proportion of the fruit produced at Young was below marketable size. The total estimated production for N.S.W. was 2 601 tonnes. The season saw a further increase in the use of mechanical harvesters for the prune crop. Many larger growers at both Young and Griffith have their own equipment while smaller growers are using contractors. With the successful use of mechanical harvesters, growers are showing more interest in the production of the crop and there has been a slight increase in the planting rate. In 1972, the total area planted in the State was 1 715 ha, and the bearing area 1 501 ha, about the same as 1971.

Plums

Setting of plums was satisfactory in most districts and thinning was necessary in many orchards, although fruit sizing was severely retarded in non-irrigated inland districts due to dry weather in the spring and early summer. Size and quality were good where irrigations were applied. The area of plums in N.S.W. has remained fairly static over recent years with a decrease over 12 months from 916 ha in 1971 to 907 ha in 1972.

Industry Developments

Difficulties were experienced in obtaining adequate labour for harvesting and pruning in most districts. There was an acute labour shortage for the harvesting of early maturing varieties at Young, and difficulties were experienced in maintaining an adequate labour force for the harvesting of canning peaches in the M.I.A. For this reason, growers generally have been particularly interested in any developments made in the mechanization of these operations.

Pests and Diseases

Fruit-fly was particularly active throughout the State, although intensified control measures kept the pest in check in commercial orchards. The fruit tree moth borer (*Cryptophasa unipunctata*) is becoming more prevalent in most districts and infestations have built up alarmingly in the Young district. There was a built up of frosted scale (*Eulecanium pruinsum*) on apricots and prunes in the M.I.A. San Jose scale (*Quadraspidiotus perniciosus*) continued to be in evidence requiring efficient control measures to keep it under control.

Green peach aphid (*Myzus persicae*) was fairly prevalent in most inland areas but was effectively controlled. Cherry orchards at Orange and Young became heavily infested with pear and cherry slug (*Caliroa cerasi*). Less severe infestations by the insect developed in other cherry districts. Spraying was necessary to combat widespread spring infestations by cherry aphid (*Myzus cerasi*) in the Orange and Batlow districts.

Peach leaf curl was more prevalent than usual, being particularly severe in orchards where growers neglected to apply control measures. Late in the season, following the heavy January–February rains, rust infections became serious on peaches, plums and prunes in most districts. Brown rot (*Sclerotinia fructicola*) caused losses in some canning peach orchards in the M.I.A. following rain in early February, but in all instances of serious loss the orchardists had failed to take appropriate control measures. Overall losses were light. Benomyl gave good control when applied as recommended. The Brown Rot

Forecasting Service worked well, the infection period being predicted several days in advance. In coastal districts, brown rot was not as severe as may have been expected, but caused losses in some early maturing varieties.

STRAWBERRIES

Plantings of strawberries have continued to increase, occupying 43 hectares in 1970, 60 hectares in 1971, and 76 hectares in 1972. Yields have been maintained at a high level and the quality and presentation of fruit have been excellent. Adequate supplies of plants have been available from growers producing certified runners under the Certification Scheme introduced by the Department in 1971.

Because of the high standard of management by most strawberry growers, virus diseases, fruit rots and leaf spot are generally well controlled. Verticillium wilt (*Verticillium dahliae*) is the main disease causing economic losses in strawberries. The use of excessive amounts of nitrogenous fertilizer is causing plant death, poor growth and scorching of the leaves shortly after planting.

NUTS

The interest shown over recent years in the possibilities of nut production in N.S.W. has continued. An area of 445 hectares of pecan nuts has been planted at Biniguy near Moree and is to be further extended this year. The first trees are expected to come into production in 1975.

During the year 81 hectares of macadamia nuts were planted, named varieties being used in all cases. The Richmond River district still dominates other areas and the Macadamia Plantation enterprise at Dunoon continues to expand. In-shell nuts commanded good prices from processors, ranging from 55 to 65 cents per kg on the farm. There were light infestations of occasional inflorescences with macadamia flower caterpillar (*Homoeosoma vagella*) at Wyrallah.

An almond growing enterprise is to be developed at Hillston and numerous enquiries have been received from other sources for information on the culture of other nut crops.

GRAPES

Seasonal Conditions

Extremely dry conditions during winter were broken by good falls of rain in all grapegrowing districts in August. Warm weather during August and September promoted early bud burst. Good rain during October in coastal and tableland districts was followed by hot, dry weather in November–January. In inland irrigation districts, the normal rostered irrigations were inadequate to prevent berry shrivel and sun-scald of wine grapes in the M.I.A. and of sultanas in the Murray River districts. Heavy rain in February throughout the State caused variable crop damage and bunch rot development. Sultana crops in the Murray Valley were the most severely damaged with all growers incurring losses through berry shedding and splitting, and mould wastage. Losses were estimated at 45 per cent of the crop. In the M.I.A. and Hunter Valley damage was less severe being mainly confined to the development of bunch rots. The rain brought the table grape harvest at Campbelltown to a premature end in early March.

Wine Grapes

Production: The quantity of wine grapes processed by wineries in N.S.W. was estimated to be similar to the record crop of 77 000 tonnes processed in 1972. Despite an increase in bearing area, only 55 780 tonnes were harvested from the Murrumbidgee and Coleambally Irrigation Areas, compared with the record 61 597 tonnes in 1972. The reduced crop can be attributed to moisture stress during December–January, and bunch rot damage in the Semillon and Pedro Ximines varieties. Average yield at 16.3 tonnes per hectare was well below the record 22.4 tonnes in 1970.

Production in the rapidly expanding Hunter Valley continued to increase and was estimated at 9 000 tonnes, double the previous record of 4 322 tonnes produced in 1972. The Hunter Valley vintage is expected to reach at least 35 000 tonnes by 1980 when extensive areas of newly planted vineyards will come into full bearing. In the Murray River district, only the early maturing varieties such as Rhine and Clare Riesling were seriously damaged by the rain, with some minor damage to Shiraz. Because of an increase in bearing area, generally good crops and increased diversion of sultana to the wineries, vintage was heavier than last season. In Mudgee, yields were 20 per cent less than normal, reflecting the dry mid-summer conditions.

Marketing: M.I.A. wine grapes prices generally increased by \$2.34 to \$6.37 per tonne depending on variety, although the price of Semillon only increased by \$0.11 per tonne. Base prices per tonne for the main varieties were Semillon \$69, Shiraz \$87, Trebbiano, Palomino and Grenache \$62, Doradillo \$54.50 and Cabernet Sauvignon \$129.

Planting statistics: The area planted to wine grapes in N.S.W. continued to increase as further plantings were made in the Hunter Valley and to a lesser degree in the Murrumbidgee Irrigation Areas. Since 1965 the area of wine grapes has more than doubled to 8 450 ha by December, 1972.

New plantings in 1972 increased the Hunter Valley area by 662 ha to 3 552 ha, of which Shiraz (47 per cent), Semillon (25 per cent) and Cabernet Sauvignon (11 per cent) are the main varieties. A further 400 ha are expected to be planted in 1973.

The rate of planting in the M.I.A. and C.I.A. has slowed following the 1972 recommendation of the M.I.A. Wine Grape Planting Advisory Committee that new plantings be limited to certain premium varieties and Muscat Gordo Blanco. The area of wine grapes increased by 153 to 3 618 ha in December, 1972, the main varieties being Shiraz (24 per cent), Semillon (20 per cent), Trebbiano (14 per cent) and Grenache (7 per cent). Because planned expansions in the operations of M.I.A. wineries require more than the potential production from the present area, the committee recommended the planting of a further 577 ha in 1973.

Wine grape plantings in the Murray River and Mudgee districts increased by 17 and 25 ha to bring their respective totals to 488 and 287 ha. The main varieties are Grenache (25 per cent), Muscat Gordo Blanco (16 per cent), Shiraz (25 per cent), Doradillo (15 per cent) in the Murray River districts and Shiraz (45 per cent), Cabernet Sauvignon (23 per cent) and Semillon (9 per cent) at Mudgee.

Wine consumption and export: Wholesale sales of wine in Australia rapidly increased from 62 939 370 litres in 1964–5 to 110 854 210 litres in 1969–70, with an increase in per capita consumption from 5.68 to 8.86 litres. Following the imposition of the 11 cents per litre excise in August, 1970, sales of wine increased only slightly to 111 108 786 litres in 1970–1. The halving of the excise in May, 1972, was too late to have a significant impact on 1971–2 wine sales figures which increased to only 116 282 134 litres with per capita consumption at 9.05 litres. This reduction and the subsequent complete removal of the excise in December, 1972, together with more aggressive marketing, is expected to return the rate of sales growth to pre-excise levels. The export of Australian wine increased slightly to 7 995 446 litres, but is still below the 9 084 635 litres exported in 1964–5.

About 45 000 tonnes of the Australian wine grape crop is used in the production of brandy. Domestic sales of brandy have increased from 2 632 040 litres of alcohol in 1964–5 to 4 560 645 in 1971–2. The fact that brandy imports in 1971–2 were 696 234 litres of alcohol is causing great concern in the local industry.

Industry situation: A shortage of harvest labour in the inland irrigation districts emphasized the need to mechanize the harvest. Four machines operated in Australian vineyards on a commercial scale during the vintage and this number is expected to increase substantially next vintage.

Despite the possibility that the rate of growth in domestic wine sales is increasing again, the Australian production potential from the 11 340 ha planted between 1968 and 1971 is so great that the Commonwealth Grape Advisory Committee considers that there will be a likely overproduction of 19 322 tonnes of wine grapes for vintage 1974 and 33 450 tonnes by vintage 1975.

Dried Vine Fruit

Production and marketing: Dried vine fruit production in 1973 from the Murray River districts in N.S.W. was substantially reduced by the adverse seasonal conditions and was estimated at 8 688 tonnes dried weight (currants 446 tonnes, raisins 1 236 tonnes, sultanas 7 006 tonnes), compared with the record 16 739 tonnes harvested in 1972. It was the third light crop harvested in the last 5 years. However, as the major dried vine fruit producing countries in the northern hemisphere also had low crops in 1972, the world market price for sultanas has more than doubled; nett returns to Australian growers are expected to be in excess of \$500 per dried tonne compared with the \$252 per tonne realized in 1972. Nevertheless individual growers, who suffered crop losses as high as 70 per cent, will be in financial difficulty. The Premier and Treasurer approved the allocation of "carry on finance" to growers in necessitous circumstances as a result of the rain damage.

The effects of rain damage were confined largely to sultanas. The fruit, although mainly sound, was lower in grade because of colour variation. The Australian Dried Fruits Association estimated sultana grades to be approximately: 4 crown, 6 per cent; 3 crown, 35 per cent; 2 crown, 48 per cent; and 1 crown, 7 per cent. The current harvest was almost complete before the rain fell, although some mould losses occurred on drying racks. Production of raisins was below normal due mainly to smaller crop development on Muscat Gordo Blanco and Waltham Cross vines, and increasing winery diversions. Some losses of Waltham Cross occurred late in the season due to *Botrytis* rot.

Planting statistics: Plantings of drying grapes in N.S.W. increased by 23 ha in 1972, bringing the total to 3 958 ha, comprising 85 per cent Sultana, 4 per cent Currant, 8 per cent Muscat Gordo Blanco, and 3 per cent Waltham Cross.

Industry development: Following the first fall of rain in February and the general shortage of harvest labour, about 150 growers used the new trellis drying method on 325 ha of vineyard. The technique,

which involves cutting the fruit bearing canes at fruit maturity, spraying the vines with dipping solution and allowing the grapes to dry on the trellis before harvest, yielded an average 0.6 tonnes dried fruit per ha compared with 0.3 tonnes for rack dried fruit. The trellis dried fruit was virtually grit free and the quality, although variable, was comparable with that produced by rack drying. Over 40 ha of the trellis dried fruit in N.S.W. was mechanically harvested with encouraging results. Winnowing of hand harvested trellis dried fruit was necessary to remove leaf trash before delivery to the packing shed. Apart from being a useful method for salvaging rain damaged sultanas, trellis drying is a low labour method of producing grit-free fruit and is expected to ultimately become standard practice.

Industry situation: Production of sultanas in Australia, which has averaged 71 500 tonnes over the past ten years, is expected to increase through the adoption of improved cultural practices. The Commonwealth Grape Advisory Committee has predicted that the existing planted area could regularly produce 91 525 tonnes of dried sultanas and that the increase would have to be sold on a static world market. Australian fruit will have to compete on this market with increased supplies from other exporting countries in the face of increased freight rates, loss of preference on the U.K. market, and the granting of associate membership of the E.E.C. to the low cost producers, Greece and Turkey.

Table Grapes

Table grapes in the Murray River districts matured early, with the marketing of Cardinal commencing in the first week of January and Sultana in the middle of January. Appreciable quantities of Sultana were marketed before rain damage in February, after which specialist table grape producers were forced to dry their product. Gibberellic acid treated Sultana grapes were extremely prone to splitting, whilst splitting of Ohanez and Red Emperor in April resulted in early curtailment of the season. The quantity of table grapes marketed from the M.I.A. increased to 1 495 tonnes compared with the 1 315 tonnes marketed last season. (For metric conversion purposes, 42 bushels of grapes have been regarded as the equivalent of 1 tonne.) This revival of interest in table grape production in the M.I.A. has been overshadowed in recent years by the booming wine industry.

Good crops of table grapes were harvested by Hunter Valley growers who are showing considerable interest in expanding plantings. In the Campbelltown district, the early season enabled Black Muscat growers at Orchard Hills to harvest the bulk of their crops before the rain in February. However, in the later maturing areas at Cobbitty and Wedderburn, heavy crop losses occurred. In the Central Tablelands crops were fair but quality was reduced because of moisture stress during the growing season.

Plantings of table grape varieties, currently 1 072 ha, are slowly declining in N.S.W. largely as a result of urban development replacing vineyards in the Campbelltown district. However, interest in specialist table grape production is strong and small plantings of new varieties such as Cardinal and Italia are being made. Production of table grapes is relatively static in N.S.W. with 7 994 tonnes being produced in 1971–2, the total Australian production being 23 673 tonnes.

Diseases and Pests

Bunch rots caused mainly by grey mould (*Botrytis cinerea*) increased losses due to rain damage. Sprays to prevent infection at flowering were not widely applied and consequently preharvest sprays applied at the onset of the wet weather were generally ineffective. Although most vineyards were well protected against downy mildew, the disease developed in some after the February rain and promoted early defoliation. The incidence of powdery mildew (*Oidium* spp) was slight. Bunch stem die back of table grapes was severe in the central tableland districts, probably due to the hot dry conditions prevailing during December–January. *Drosophila*, or ferment fly, aggravated the poor condition of grapes being rack dried.

TROPICAL FRUITS

Seasonal Conditions

Very favourable conditions were experienced generally with the mild winter followed by a warm to hot growing season. Above average rainfall was recorded in all districts, most falling in the summer months. However, unusually high falls of about 89 cm were registered in some areas in October. July–September was dry, yielding only about 10 cm over the three month period. High winds damaged some banana plantations, and severe hail storms in the Coffs Harbour and Tweed districts resulted in fruit losses.

Bananas

Area and production: An accelerated decrease of 640 ha from the previous year left 8 207 ha under crop at December, 1972. The decline occurred in all districts, the greatest being in the Tweed and Brunswick. The number of commercial growers correspondingly decreased from 2 166 to 2 030. Consignments through the industry transport system to the major markets in various states totalled

69 268 tonnes, while direct sales and local disposal were estimated to account for approximately 7 317 tonnes, giving a total of about 76 585 tonnes. (For metric conversion purposes, 41 bushels of bananas have been regarded as the equivalent of 1 tonne.) Production decreased in all districts, the greatest drop being in the Brunswick area.

Marketing: During the winter months the average wholesale price reached the highest level for many years due to very light production from both N.S.W. and Queensland centres. This was followed by heavy oversupply during the October–April period.

Industry developments: The industry implemented a national Banana Marketing Development Scheme in which fruit failing to reach an agreed minimum price was removed from the market. The scheme operated successfully during the peak supply period when 89 000 packages of small or inferior fruit were removed from the market, the growers being paid the minimum price. The problem of “mixed ripe” fruit reaching the interstate southern markets resulted in the Victorian authorities advising the industry that such fruit is unacceptable because of its possible association with fruit-fly, and will be destroyed. Three central packing houses operated for part of the year but lack of grower support forced one to close down. The banana varieties Maroochy Mons Mari and Dwarf Mons Mari were introduced from Queensland for commercial planting on the Brunswick.

Pests and diseases: Dieldrin resistance in banana weevil borer spread further and was confirmed in more plantations on the Tweed, Brunswick and Richmond, but has not yet appeared in the Coffs Harbour/Nambucca areas. Several new chemicals for weevil borer control have been tested extensively and await registration. The number of plants detected with bunchy top virus was 1 099, an increase of 122 compared with last year. Most of the infections were in the Tweed district. The position is satisfactory having regard to the reduction in detection staff effected during the year by the Banana Growers’ Federation.

Conditions were favourable for the development of leaf spot (*Mycosphaerella musicola*) and leaf speckle (*M. musae*) during the wet humid weather in late spring and summer. Later the warm dry conditions resulted in good growth and delayed disease development. Corky scab was more prevalent in all areas than for many seasons.

Avocadoes

A heavy fruit setting occurred in most areas. This carried through to maturity except in the northern areas where a heatwave in December–January caused heavy shedding. The protracted period of high rainfall caused waterlogging in the heavier soils and tree losses were high.

The planted area increased from 147 to 183 ha, of which only 15 per cent were bearing. Production increased to 16,000 single layer trays (about 116 tonnes) marketed through the southern outlets, and about 5 000 trays sold locally. The market was buoyant throughout the year and returns were excellent, wholesale prices ranging from \$4 to \$21 per tray. Highest prices were realized for late hung Fuerte and Hass varieties. Immaturity of early harvested varieties remains a problem and investigations to determine suitable maturity indices are proceeding.

Avocado land has been selling for \$1,250–\$2,500 per ha and development and establishment costs to the sixth year can be expected to add approximately \$5,700 per ha to this figure. These high costs discourage many prospective growers.

Loss of trees of all ages due to root-rot (*Phytophthora cinnamomi*) continued where trees had been weakened during the previous wet season. Many growers have accepted the concept of biological control using organic mulching materials combined with calcium, magnesium and nitrogen.

Latania scale (*Hemiberlesia lataniae*) infested newly planted avocado trees. Swarms of red-shouldered leaf beetle (*Monolepta australis*) occurred in the Brunswick and Richmond districts, with damage to fruit of avocado from mid-December until early February. Lighter infestations of the fruit developed in the mid-summer in the Tweed and at Coffs Harbour. Where DDT had been used in the previous summer, a build up occurred of scale insects including latania and pink wax. Anthracnose infections on early season fruit were severe, and heavy losses occurred both in the field and after harvest.

Passionfruit

The weather favoured vine growth and good crops developed. The planted area in the State declined from 182 to 129 ha, but interest has revived in the northern areas where further plantings are proposed. Fresh fruit found a good market at satisfactory prices and a small processing outlet commenced operation on the Richmond River. Plantings in the north are now almost 100 per cent hybrid varieties and yields per hectare have more than doubled.

Brown spot (*Alternaria passiflorae*) and septoria spot (*Septoria* spp.) were difficult to control because of the warm humid conditions experienced until late in the autumn. Passionfruit leaf miner caused damage

to leaves and fruit in the Brunswick district, where it had not previously been recorded. The use of *P. edulis f. flavicarpa* as a rootstock for hybrid types has reduced the incidence of fusarium root rot in northern areas.

Other Tropical Fruits

The area of pineapples increased slightly to 63 ha but no major expansion is expected unless processing outlets become available. Small trial plantings of litchis and Chinese gooseberries have been made in the search for alternatives to bananas.

WOOL AND SHEEP MEAT

Record prices for wool, lamb and mutton during the year caused graziers to show renewed but still cautious interest in sheep. However, those who completely moved out of the industry during the period of depressed prices showed little desire to return exclusively to sheep, and heavily committed themselves to cattle.

Values for all classes of sheep were high and are likely to remain so for some time. An estimated fall in sheep numbers of 15 per cent occurred over the twelve months and no significant increase is expected for 1973–4.

Important reports presented during the year were the Randall Report on the sheep industry, the final report of the Australian Objective Measurement Project, and the Report of the Select Committee of the Legislative Assembly Upon the Meat Industry.

The Australian Wool Board and the Australian Wool Commission amalgamated to form the Australian Wool Corporation. A poll of meat producers resulted in a majority vote for the formation of a statutory sheep meats marketing board.

Wool Production

The decline in wool production, apparent over recent years, continued. The reduction could be up to 20 per cent on that sold during 1971–2. The causes were lower sheep numbers and poor seasonal conditions in much of the state for about half the woolgrowing year. The Bureau of Agricultural Economics predicted that wool will stabilize at the 1972–3 level. Since that prediction was made, however, reports indicate a further fall in New South Wales wool production.

High prices for sheep are limiting attempts to increase flock size. Moreover, despite high wool and sheep returns, the rural recession left many producers with poor cash liquidity. Less slaughterings and deaths are expected than occurred last season, but they are not likely to prevent a further decline in sheep numbers because of reduced matings in 1972–3 and poor lambings over the last two seasons.

Sheep Meat Production

Lamb, hogget and mutton realized extremely high values. Slaughterings for lamb and mutton in New South Wales were about 20 per cent less than in 1971–2, a situation not likely to be quickly corrected. In fact, industry surveys forecast the breeding of fewer meat-type sheep during 1973–4. Causes of the lower production were the decline in sheep numbers generally, a trend towards wool production, and poor seasonal conditions during the first half of the year.

Wool Marketing Developments

Average weekly prices for all classes of greasy wool rose from 99.71 cents per kg in August, 1972, to 207.03 cents per kg in June, 1973. The average for the season was 183.0 cents per kg. This compares with an average of 72.25 cents per kg for 1971–2. Purchases by the Australian Wool Corporation were minor and the wool stockpile of the previous season was eliminated. The Deficiency Payment Scheme, embodying a Government guarantee of 79.37 cents greasy to the grower, did not need to be invoked.

A 1.5 million dollar project to investigate the cost and practicability of a system of sample testing and sale by sample was finalized. The project report, together with findings from other sources, is currently being examined by the Australian Wool Corporation. The project entailed the examination of alternative methods of marketing the clip. In the meantime, objective measurement and the implementation of new techniques of wool handling through its use is rapidly occurring in the selling system. There was much misunderstanding among growers of the marketing changes and this will probably persist until the Australian Wool Corporation is in a position to make specific recommendations.

The implications of these changes on flock breeding is not fully understood by many producers.

Interest in selling wool other than through the auction system continued. The major company operating in this field expanded further and sold 65,000 bales by tender auctioning from a displayed clip sample with test certificate. Prices were at least equal to those obtained through the general auction system, but the main advantage of the method lay in considerable economies from reduced handling.

A large scale experiment was commenced at Goulburn to investigate and develop more efficient rehandling procedures, and to build larger lots from mixed pool and bulk classed wools. It is envisaged that the system developed will replace the Price Averaging Plan which has proved costly to administer and has brought unfavourable comment from the industry.

Sheep Meat Marketing Developments

The producers vote to establish a statutory sheep meats marketing board under the Marketing of Primary Products Act was contrary to the recommendations of the Select Committee of the Legislative Assembly Upon the Meat Industry, which considered that such a board would not have sufficient powers to deal with many of the marketing problems that need rectifying. As a result of the poll, however, a Sheep Meats Marketing Board is being established.

A development that caused concern was the purchase of valuable breeding stock for slaughter, resulting from intense competition between restockers and meat buyers. No early solution to this problem appeared possible.

Sheep Management Developments

More attention was paid to management this year. During the slump, many flocks were neglected with costs such as those for mulesing, drenching, dipping and vaccinating being minimized. This attitude has now changed. Most sheep properties are now viable even though debts have not been eliminated. Many owners would have liked to build up sheep numbers but were deterred by the high sheep prices. Increased crop areas proved a simpler short term economic expedient.

The relative scarcity of finished lambs due to poor seasonal conditions and the availability of store lambs made lot feeding of lambs an economic enterprise. Good results were generally obtained with inexpensive facilities. As a result, producers can now regard this method of feeding as normal when similar circumstances exist.

Pests

The sheep blowfly involves the wool industry in an enormous annual cost (estimated \$28 million in 1969–70). The constant development of flies resistant to insecticides and the failure of producers to undertake recognized control measures have further accentuated the problem. Considerable research on the subject is being pursued by this Department, other government agencies and chemical companies.

BEEF

Production

Both cattle numbers and beef production continued to increase as shown by the following statistics:

	1971–2	1972–3	Change per cent
Cattle nos (cattle mainly for meat)	6,572,000	7,049,000	+ 7.25
Slaughterings—			
Cattle nos.	1,460,000	2,059,600	+ 41
Calf nos.	244,000	279,500	+ 14
Production (carcass wt tonnes)	303,900	413,110	+ 36

The rate of build up of beef herds, which was so strong in the years following the droughts of the mid-sixties, declined. However, numbers of cattle slaughtered greatly increased.

Markets

Since the late sixties the trend has been for exports to increase, but at a decreasing rate until 1971. Subsequently a number of developments have contributed to a marked expansion of exports. These have included: seasons generally favourable for cattle; the suspension of quantitative restrictions on exports to

the U.S.A.; the temporary removal of tariffs on beef imports by the U.K. and the E.E.C.; an increase of 60 per cent in Japanese beef import quotas for 1972–3; and the suspension, in March, 1973, by the Australian Meat Board of the diversification scheme, which had regulated exports to the U.S.A. Another influence contributing to the remarkable export demand may be the retention of live cattle by importing countries, to increase their own breeding herds.

Exports of Australian beef and veal, shipped weight, for the eleven months ending May, 1973, compared to the 11 months ending May, 1972, increased by 21 per cent to 280 178 tonnes to the U.S.A., by 73 per cent to 75 638 tonnes to Japan, and by 150 per cent to 96 879 tonnes to the U.K. Exports to all countries increased by 43 per cent to 524 281 tonnes.

Price rises for live cattle and beef have resulted from the export demand and there has been adverse consumer reaction to high retail prices. The greatest price increases have been for heavier cattle which satisfy the demands of both lean beef and prime beef export markets.

Developments

Much interest has been displayed in the problems of marketing and market reporting. Investigations into the formulation of a product description system are being carried out to provide the basis for more informed trading decisions by all sectors of the industry. There has been a mixed reaction to the introduction of liveweight selling facilities at saleyards, and although facilities of this type have been installed at more centres some resistance to their introduction has been obvious.

During the year, 3,500 cattle and 14,400 doses of semen were exported. Approximately 2,000 live cattle were imported from New Zealand and 120,000 doses of semen from the U.K., New Zealand and Canada.

The results of the 1972 Australian Beef Cattle Industry Survey covering the period 1968–72, carried out by Bureau of Agricultural Economics have not been published. However, the survey is understood to have shown that there was a marked redistribution of cattle in N.S.W. with a greater proportion in the wheat/sheep zone, that ample scope existed for development of higher stocking rates, that the average branding percentage was acceptable, that most slaughter cattle were sold at auction, and that supplementary feeding to fill the feed-year gap was widely practised.

The high prices for sheep meat, wool and grain in 1972–3 may divert resources from expansion of beef herds, particularly in the wheat/sheep zone, and thereby encourage higher rates of turn off. However, because of the scope for higher stocking levels, it is not expected that such diversion of land resources will prevent a steady expansion of both cattle and sheep numbers.

Lot feeding

Lot feeding has provoked considerable speculative interest and will continue to have a role in maintaining continuity of beef supply and consistency of product. However, the nature and rate of expansion will be governed by the financial advantages of operating comparatively large enterprises and the continuance of favourable markets.

DAIRYING

Season

The 1972–3 season produced varied conditions throughout the State. Very dry to drought conditions occurred in the southern and south western areas during the first half of the season, while floods were experienced north of the Macleay in October and again during February on the Richmond and Tweed. Although some of the floods were major, production was not affected to any great extent. Extremely hot and humid weather was experienced throughout the whole State during the summer months.

Because of the varied seasonal conditions, pasture and crop production were seriously affected in southern areas until late summer. In northern areas pasture and crop production was fair to good, with increased areas being sown down to improved pasture. Production throughout the year was maintained at a satisfactory level.

Production

Government statistics for the year ending 31st March show that milk equivalent production for the State was 1 193 million litres an increase of 2.5 per cent over last year. Production for the previous 5 years was as follows: 1967–8, 1 436 million litres; 1968–9, 1 247 million litres; 1969–70, 1 413 million litres; 1970–1, 1 269 million litres; 1971–2, 1 164 million litres. Average production over 5 years was 1 306 million litres.

Industry Developments

The number of dairymen supplying factories in the State continued to decline. There was a fall of 6.7 per cent from 7,072 at 31st January, 1972 to 6,596 at 31st January, 1973. All districts experienced a fall except the South Western area where a slight increase occurred. Dairymen leaving the industry have been mainly cream suppliers. They have changed chiefly to beef cattle raising or retired from primary production due to age.

There has been a general transfer from cream production to whole milk in areas outside the old milk zone. Herds are now increasing in size, and there are many with more than 100 cows. In very large herds there has been a move to rotary-type sheds. Farmers who were previously outside the old milk zone are rapidly changing to all-year-round calving to maintain an even milk supply.

The expansion of bulk milk collection showed an increase of about 3 per cent to 3,884. This trend is continuing but is less spectacular than in previous years, as the number of dairymen remaining in the industry continue to decline.

A factor influencing the move out of dairying along the coastal strip has been the purchase of large areas of good farming land by developers for resale for residential purposes or small hobby farms resulting in a gradual reduction of dairy production on the North Coast. Factory managers are finding it increasingly difficult to obtain sufficient supplies of whole milk for buttermaking.

Markets

New South Wales continues to import most of its butter and cheese. Some fancy cheeses are being imported from overseas. The market for dairy products continued to increase slowly with population growth. The 1972 Annual Report of the Australian Dairy Produce Board shows that cheese consumption is 4.17 kg per head and butter is 8.62 kg per head. The domestic market for cultured milk products and fancy cheese is steadily improving.

Butter

Total butter production in New South Wales was 17 966 404 kg compared with 18 933 714 kg last year. Butteroil production of 5 253 435 kg was mostly made from butter transferred from other States. The main reasons for the decline in butter manufacture have been an increase in the amount of milk required for liquid milk consumption, and more attractive prices paid for milk used for the manufacture of cheese and other dairy products. The trend away from butter manufacture in New South Wales commenced several years ago and is expected to continue.

Cheese

Because of the diversion of milk previously used for buttermaking, production of natural cheese increased from 7 040 526 kg in 1971–2 to 8 895 929 kg in 1972–3; and of processed cheese from 1 476 493 kg in 1971–2 to 1 600 000 kg in 1972–3. Cheddar, Cheedam, Drum production in 1972–3 was 6 958 823 kg (+ 28 per cent on 1971–2); Farm and Cottage 1 042 730 kg (+ 25 per cent); Mozzarella, Pizza, Halaumi 350 832 (+ 57 per cent); Parmesan, Roman, Sardo, Pecorino 65 506 (+ 18 per cent); Ricotta 142 891 (– 0.4 per cent); Fetta 194 856 (+ 19 per cent); fresh curd ripened cheeses 140 283 kg (–18 per cent); processed cheese 1 605 988 (+ 9 per cent).

Cheese was imported from 21 countries. Total imports were 2 861 847 kg compared with 2 068 968 kg last year. New Zealand was the main source of imported cheese with shipments totalling 617 455 kg. A small export trade commenced of Pastorella, Fetta and Sardo Cheeses to Canada.

Quality improvement programme: To assist cheese quality improvement, meetings with manufacturers were held and agreement reached on preventing low acid type cheddar from being sold as natural cheese. All cheddar not meeting the agreed standard is now diverted to processing. A retail survey comprising 100 samples (76 cheddar and 24 non-cheddar varieties) was conducted with disappointing results on organoleptic grading. However chemical composition and biological quality were satisfactory. Monthly samples of cheese from manufacturers continue to be analysed, and defects are corrected where necessary.

Condensed and Dried Milk Products

Manufacture of condensed and dried milk products was 42 203 239 kg in 1972–3, an increase of 53 per cent on the previous year. The largest increases were in the two major products skim-milk powder (+ 82 per cent) and whole milk powder (+ 85 per cent), with smaller increases in infant foods (+ 11 per cent), sweetened condensed milk (+ 20 per cent), buttermilk powder (+ 9 per cent). Decreases were recorded in Milo (– 29 per cent), malted milk (– 37 per cent), butter and skim powder (– 43 per cent), and stock foods (– 9 per cent).

An increasing demand for condensed and dried milk products and difficulties in obtaining sufficient supplies of milk for manufacturing purposes has increased the price on the retail market.

Other Milk Products

With the exception of cultured buttermilk, production of other milk products increased in the year ended 31st March, 1973. Details are as follows: yoghurt, frozen yoghurt, cultured buttermilk and sour cream, 1 454 407 kg; cream mix, thick cream mix and cream mixture, 782 932 kg; ice cream, 45 014 133 litres; Sprade®¹, 3 744 381 kg; other products, 4 893 847 kg.

The use of most cultured milk products continues to grow. This is a lucrative market and can be expected to expand still further.

MARGARINE

The Australian Agricultural Council decided in February, 1973, that the Australian table margarine total annual quota be raised from 16 256.8 to 22 505.5 tonnes. The New South Wales increase was from 9 144.45 to 10 973.34, and it became legally effective from 2nd May, 1973. The manufacturers made their additional quotas of margarine before the end of the 1972–3 financial year.

New Zealand has removed an embargo on the importation of polyunsaturated margarine. Export sales from New South Wales for table margarine increased from 170 tonnes in 1971–2 to 969 tonnes during 1972–3. The bulk of the sales have gone to New Zealand as polyunsaturated margarine.

Australian manufacture of cooking margarine in 1 lb packs and under, increased from 20 680 tonnes in 1970–1 to 23 562 tonnes during 1971–2. Sales for July to December, 1972, amounted to 12 978 tonnes, an increase of 1 274 on the corresponding period in 1971. The bulk of this class of margarine is sold as a substitute for butter.

PIG MEAT

Pig Production

Expansion of the State's pig industry during 1972–3 was even more dramatic than in the previous year. Brood sow numbers rose from 118,000 to 161,000, an increase of 36 per cent. As a consequence, pig production is expected to increase by about 450,000 and the total number of pigs in N.S.W. to rise to 1,060,000.

Pig slaughterings in N.S.W. should increase by 200,000 to 1.25 million. However, slaughterings do not give a true indication of the increased production owing to the large number of pigs consigned for slaughter in Queensland and Victoria. The average dressed weight of pigs slaughtered fell from 45 kg to 44 kg indicating an increase in the percentage of pigs sold as porkers instead of baconers.

Rises in the cost of grain, because of lower availability caused by drought, and high prices for protein supplements, drastically lowered the profitability of pig-raising. Many smaller producers left the industry or reduced the size of their enterprises. As a result, the sow population could fall in late 1973 to the 1971 or earlier levels. However, there is evidence that some large scale producers are planning to increase the size of their establishments and others intend to establish large scale specialist operations. It is predicted that these types of enterprises could account for 20 per cent of production by the end of 1974.

Cost-Price Structure

Prices during 1972 fell by an average of 17 cents per kg and were at times below cost of production. Early sales in February, 1973 saw a recovery, and by mid-year prices were at the levels of early 1972. A noticeable feature of pigmeat prices in 1972 was the wide range between the top and lower levels for all weights, indicating the extent of buyer preference for quality carcasses. The development of marketing groups has resulted in an appreciable price advantage to members, and the trend away from the traditional saleyard selling in favour of consignment and over-scales methods has increased.

Consumption of Pigmeats

Domestic consumption continued the slight annual increase of the last decade and was again largely influenced by population increase and substantial substitution of pigmeats for beef and sheep meats in diets. Pork consumption per capita is estimated as being 6.9 kg, the same as last year, whereas consumption of bacon rose from 4.6 kg to 5.5 kg per head.

Exports and Imports

It is estimated that exports will total 13 000 tonnes in 1972–3, a rise of 9 000 tonnes on the previous year and will have a value of \$10.5 million. It now appears possible that this market could continue to expand in future years. Some imports of pigmeat from overseas occurred in a processed form, but were of minor significance.

® Registered trade name.

EGGS AND POULTRY MEAT

Egg Production

The egg industry situation improved during 1972-3, with returns to producers being substantially higher than during the previous year. Both stocks of surplus egg pulp and level of egg production were reduced. Increased sales of pulp on the overseas and local markets, together with a Commonwealth grant of \$750,000, allowed the Egg Marketing Board to remove the State pool on eggs; but the Commonwealth hen levy remained at a maximum figure of \$1 per bird. Low returns during 1971-2 and the imminent introduction of egg stabilization were responsible for the reduction in hatching of replacement pullets during the latter half of 1972 and early 1973, and the subsequent decrease in egg production since December, 1972. A severe heat wave in February, 1973, killed 120,000 layers and depressed the production of survivors for several weeks.

During the 10 months to May, 1973, eggs received at Egg Marketing Board floors amounted to 58.7 million dozen and sales by producer agents 15 million dozen. These figures are 3.2 and 1.1 per cent respectively lower than for the same period the previous year. Returns to egg producers during this time in 1972-3 were 31.09 cents per dozen compared to 26.29 cents per dozen for the corresponding period in 1971-2. The improved returns to producers were to some extent eroded by higher feed prices, especially meatmeal.

Sales of eggs by the Egg Marketing Board for the 10 months to May, 1973, were approximately 5.2 per cent higher than for the same period the previous year. This is thought to be largely due to the increased consumer price of other foodstuffs, particularly meat.

Following a poll of producers, a Licensing Committee was formed under the Egg Industry Stabilisation Act to determine basic hen quotas for eligible producers. The number of flocks declined from 2,279 in November, 1971, to 1,977 in November, 1972, continuing a trend to fewer but larger flocks.

The low returns to producers for most of the year reduced the adoption of improved technology requiring capital expenditure. However, forced moulting and restricted feeding were fairly widely practised.

Poultry Meat Production

Production of meat chickens during the first half of the year was similar to the previous year, but a build up of frozen stocks caused a decline in production during December and January. Then the February heatwave killed 600,000 broiler chickens and 120,000 broiler breeder hens. This led to insufficient finished birds and reduced production at a time of increasing demand for chicken meat because of the high cost of other meats. An estimated 32.9 million chickens were processed in N.S.W. during the 8 months ending February, 1973, compared to 33.5 million for the same period in 1972.

The broiler industry was affected by a shortage of fish meal and the high price of other protein supplements. The pool system of contract production continued to operate, but was adjusted to reduce the average returns to growers. As a result, growers' overall returns were below their estimated average cost of production. Moreover, the development of company farms by a major poultry organization undermined the security of contract growers. Encouragement by integrators and the effects of the heatwave increased the amount of insulation used. Low returns reduced interest in controlled environment shedding, which requires a substantial capital investment.

HONEY

Production

Although some honey producers enjoyed record yields, the season proved difficult for most, and if prices for honey had not reached record levels many beekeepers would probably have been forced out of business. The extremes in production were mainly caused by unpredictable and unfavourable weather coinciding with the flowering of particular species. The main honey flows were in the north of the State.

Markets

Because of a remarkable overseas demand, honey prices steadily increased during the year and returns as high as 66 cents per kg were obtained by producers. Medium quality honey which would have returned 24.2 cents per kg in May, 1971, and 38.5 cents per kg in May, 1972, increased further to 58.3 cents per kg in May, 1973. The unprecedented honey prices encouraged renewed interest in the industry, particularly by medium and small producers and some not previously associated with bee farming. Many decided to outlay considerable capital on labour-saving devices. The trend towards central extracting with an increase in hive numbers and honeycombs was accelerated.

Hazards

There has been little change in the incidence of disease in recent years. The widespread use of toxic insecticides, however, particularly if applied at certain times or by aircraft and drift, has created a hazard that is steadily becoming more of an economic threat than disease.

The hazard has increased because of more general plantings of such crops as cotton, sorghum and sunflowers, which require treatment against *Heliothis* sp.

PEST INCIDENCE – GENERAL

Pasture and Field Crop Pests

The Australian plague locust (*Chortoicetes terminifera*) was again very active in the Far West and southwest throughout the season, and in the Central West in autumn.

Wingless grasshopper (*Phaulacridium vittatum*) caused extensive damage to natural and improved pastures in early summer throughout the Southern Tablelands and South West Slopes during a period of severe drought. Damage was also reported from several locations in the Central and Northern Tablelands. It was associated, in mixed populations, with large numbers of yellow-winged locust (*Gastrimargus musicus*). This species damaged pastures on creek flats, but was not thought to be such a serious pest as wingless grasshopper.

Brown cutworm (*Agrotis munda*) affected the establishment of grain sorghum, lucerne, sunflower and maize in inland areas during spring and early summer. However, the incidence of the insect and extent of damage were much less than last year.

A prolonged dry spell during autumn and winter was unfavourable to blue oat mite (*Penthaleus major*) and red-legged earth mite (*Halotydeus destructor*), and few instances of injury to autumn or winter-sown pastures and crops were reported.

An outbreak of caterpillars of a weed web moth (*Loxostege* sp.) and a sphingid (*Celerio lineata livarnicoides*) occurred in Far Western districts during late summer and autumn. Extensive areas of saltbush, blue bush and native grasses as well as vegetables and ornamental plants were affected.

Stored Products Pests

Grain pest samples from bulk storages, grain handling premises and farms have been examined for resistance at the Biological and Chemical Research Institute, Rydalmere, for the past 5 years. The situation has rapidly worsened from 1968 when maldison (Malathion ®) resistance was detected in rust-red flour beetle (*Tribolium castaneum*), to the present when five major grain pests are known to have developed maldison resistance in N.S.W. The resistant grain pests, including two weevils, two flour beetles and the grain borer, have been detected mainly at bulk storages, mills and produce stores.

The situation is not serious enough to endanger export markets, but much greater vigilance will be required on every farm to prevent the spread of resistance. Extension officers are therefore stressing the need for much more effective grain pest control on the farm, with special reference to hygiene to reduce our reliance on insecticides.

Heliothis caterpillars

Conditions during the late summer and early autumn were very favourable for the development of unusually large populations of heliothis caterpillars on many crops throughout the State and were particularly abundant on cotton in the Namoi Valley. For the first time in this area plague proportions were reached by the cotton bollworm (*Heliothis armigera*), which is also commonly called corn earworm, tomato grub and tobacco budworm, due to its wide host range, including cotton, grain sorghum, maize, lucerne, sunflower, rapeseed, soybean, tomato, cabbages and cauliflowers. Insecticide treatments normally used were inadequate. The development of resistance to DDT and endrin by cotton bollworm compounded the problem, especially in cotton, which is usually infested with the common bollworm (*Heliothis punctigera*). The latter is still susceptible to DDT.

Queensland Fruit Fly

Queensland fruit fly (*Strumeta tryoni*) frequently occurred in coastal districts and was adequately controlled. The pest was much more prevalent than normal in inland areas for the third year in succession. The most serious outbreak for 15 years was experienced on the Murrumbidgee Irrigation Area, with infestations being common in home garden fruits in towns and with some occurrences in orchards. Rigorous control measures were introduced.

Vegetable Pests

Tomato, sweet corn, pea, bean and cruciferous crops were damaged by caterpillars of *Heliothis* spp. during late summer and autumn on the central coast and north coast and in the Western Districts. Grey cabbage aphid (*Brevicoryne brassicae*) affected turnip and brussel sprout crops in tableland regions during autumn. Other pests requiring control measures included cabbage moth (*Plutella xylostella*) at Bathurst; pumpkin beetle (*Aulacophora hilaris*) and 28-spotted ladybird (*Hemioepilachna vigintioctopunctata*) in the Murrumbidgee Irrigation Area; green looper (*Plusia chalcites*) in beans and onions; and thrips (*Thrips tabaci*) in onions.

Domestic pests

As a result of a highly successful publicity campaign conducted from February to April, which yielded 27,000 samples of ants, 9 new areas of Argentine ant infestation were found and are being treated or prepared for treatment. An independent campaign sponsored by the Newcastle City Council during May yielded no Argentine ants.

2. ADMINISTRATION

CENTRAL ADMINISTRATION

Central Administration embodies the Executive and branches providing centralized administrative services for the Department. The main functions of the branches are:

Central Secretariat

Provides secretarial and service assistance for the Minister and Executive, keeps central records system, conducts general correspondence and deals with matters concerning office accommodation.

Staff and Personnel

Concerned with the recruitment, induction and counselling of staff, the processing of matters related to salary, allowances, promotion, leave and seniority and the maintenance of salary, leave and other staff records.

Accounts

Receives and pays public moneys, keeps financial records, controls purchases, and inspects accounts of branches and institutions.

Legal

Promotion and drafting of bills, drafting of regulations and proclamations, conduct of prosecutions, preparation of legal documents and legal advisings, registration of veterinary surgeons and licensing of farm produce agents.

Automatic Data Processing

Investigates, advises and conducts computer programmes and associated work.

Organization and Methods

Surveys, investigates, and reports on improved work methods.

Pesticides Registration

A separate section within Central Administration was established during the year to be responsible for the registration of pesticides under the Pest Destroyers Act, 1945.

Others within the definition of Central Administration are the executive assistant to the Senior Deputy Director-General, the staff development officer and the safety officer.

Separate reports are given in this section of the more important activities during the year of the Central Administration components.

ACCOUNTS

Departmental

The Department of Agriculture's day-to-day running costs are met from Consolidated Revenue Account. Receipts from the administration of various Acts of Parliament, as well as contributions from the Commonwealth towards certain specified functions, are paid into Consolidated Revenue.

Expenditure during 1972–3 by the Department from this account totalled \$26,117,307 while revenue amounted to \$6,812,360.

The expenditure of \$26,117,307 financed such functions as:

● Cattle Tick Control	\$5,334,398
● Maintenance of Agricultural Colleges	\$3,961,210
● Maintenance of Department's Research Stations	\$2,743,970
● Royal Botanic Gardens Upkeep	\$ 864,738

Extension and Applied Research

Apart from finance from Consolidated Revenue, the Commonwealth provides a special grant known as the Commonwealth Extension Services Grant. Expenditure from this source amounted to \$1,646,755 during 1972-3, and was devoted entirely to extension and applied research. A comparative itemized statement of this expenditure is included in Appendix 1 of this report.

Other Research Finance

Funds provided by industries, semigovernment bodies and special Commonwealth grants are utilized in many research programmes and projects conducted by the Department. The Department relies heavily on this finance for research work and expenditure from this source amounted to \$1,145,341 in 1972-3. To this is to be added an estimated amount of \$730,000 as the research component of Commonwealth Extension Services Grant. Details of the calculated figures are shown in the following statement:

<i>Fund</i>	<i>1970-1</i>	<i>1971-2</i>	<i>1972-3</i>
	\$	\$	\$
* Industry/Commonwealth Extension Services Grant, Special Research Fund	14,900	15,400	29,826
Wheat Industry Research Committee of New South Wales	138,604	115,560	97,721
Wheat Industry Research Council	52,066	57,320	57,255
Wheat Industry Stabilisation Fund	—	—	4,066
Australian Meat Research Committee	166,996	208,045	295,670
Wool Research Trust Fund	388,097	384,433	388,616
Australian Wool Corporation Post-graduate Scholarships	19,683	20,686	19,129

<i>Fund</i>	<i>1970-1</i>	<i>1971-2</i>	<i>1972-3</i>
	\$	\$	\$
Australian Dairy Produce Board	80,156	70,605	69,369
Banana Research Advisory Committee	10,605	4,125	—
Tobacco Industry Trust Account	55,695	63,532	58,118
Rural Credits Development Fund	10,000	39,000	53,900
Council of Egg Marketing Authorities of Australia	2,250	1,050	4,840
Australian Chicken Meat Research Committee	5,750	9,870	10,650
Dried Fruits Research Committee	—	2,050	13,700
Australian Pig Industry Research Committee	—	—	42,481
<u>TOTALS</u>	\$944,802	\$991,676	\$1,145,341

* Total grants received from industry and the C.E.S.G./Special Research Grant were: Mushroom (\$11,500), Bean (\$6,326) and Rice Header (\$12,000).

Capital Works Programme

Funds for various capital works programmes are provided from General Loan Account and Commonwealth Grants under the Advanced Education and Technical Training Acts. General Loan is financed entirely by the State of New South Wales, while Advanced Education is financed \$1 for \$1 by the Commonwealth and the State. Technical training is wholly financed by the Commonwealth.

Expenditure in 1972-3 on capital works amounted to \$3,684,391, made up of \$625,000 from General Loan, \$2,653,486 from Advanced Education and \$405,905 from Technical Training Funds.

Details of the Department of Agriculture's financial operations under Consolidated Revenue Fund, General Loan Fund and various Special Deposits Accounts appear in Appendix I of this report.

OFFICE ACCOMMODATION

Action proceeded during the year with the Public Service Board and the Government Real Estate Section towards the improvement of the general standard of office accommodation in country centres. Successful negotiations were undertaken regarding the renewal of leases which were due to expire although in most cases rental rates were increased.

In the Tick Quarantine Areas a number of school sites and associated buildings were taken over by the Department to provide office and accommodation facilities for the inspectorial staff.

The following is a summary of those centres where new accommodation has been secured or improvements made to existing accommodation or where attention is being given to improving accommodation:

Barham: The Public Service Board has approved of the extension of the Forestry Commission's offices to accommodate the Department of Agriculture staff and these will be undertaken when funds are available.

Bega: The Public Service Board has under consideration structural alterations to the Government-owned premises to improve noise and other adverse working conditions.

Bourke: Action is proceeding to improve the air-conditioning equipment.

Deniliquin: The Public Works Department is undertaking a survey of the renovations and repairs necessary to bring the offices to a reasonable standard.

Gunnedah: Most of the walls and partitions have been repainted which has greatly improved the appearance of the office accommodation.

Kyogle: Alternative accommodation was occupied in September, 1972, which is vastly superior to the previous accommodation.

Macksville: After some delay internal painting of the Macksville office was completed.

Moree: Offices occupied in the new Government Office Building with all the facilities of first-class modern office accommodation.

Parramatta: The Housing Commission renovated its premises as a result of which the Department's accommodation has been much improved and slightly extended.

Queanbeyan: The Government Real Estate Section successfully negotiated with the owner of the rented premises to undertake urgently needed repairs.

Wagga Wagga: A Veterinary Diagnostic Centre has been constructed by the Department at Wagga Agricultural College, with provision for office accommodation for the District Veterinary Officer, Wagga and his staff.

Windsor: Work on the renovation and refurbishing of the old council chambers is almost complete.

Country offices which call for special mention as being in urgent need of improvement in accommodation, where the problem is not easy of solution, are the Regional Office at Leeton, the District Veterinary Office at Narrandera and the District Offices at Casino and Mullumbimby.

The main developments during the year in regard to city office accommodation were:

- The transfer of the staff of the Divisions of Plant Industry and Horticulture and the Biometrical Branch from Mark Foy's Building to Union Carbide House, Liverpool Street.
- The transfer of twelve of the staff of the Division of Marketing and Economics from the State Office Block to V.A.C.C. House, William Street because of overcrowding.
- The location of the newly established Pesticides Registration Section in Anchor House, Bridge Street.

In each case the arrangement is a temporary one pending permanent location with the remainder of head office in the Rawson Place Building at present in the course of construction.

COMMITTEES, COUNCILS AND TRUSTS

Australian Agricultural Council

The Council which comprises principally the Ministers of Primary Industry or Agriculture of the Commonwealth and the States met on four occasions during the year at Mackay in Queensland, Melbourne and Canberra (twice). The meetings were, in accordance with practice, immediately preceded by meetings of the Standing Committee which are attended by delegations from the respective Departments led by the permanent head. Some of the more important matters dealt with at the meetings were wheat industry stabilization, table margarine production quotas, grain infestation, rural reconstruction and brucellosis and tuberculosis eradication.

Farrer Memorial Trust

A donation of \$1,000 received from the Wheat Industry Research Committee of New South Wales was credited to the capital fund, which stood at \$23,647.75 at 31st December, 1972. Accounts compiled at

that date revealed that total funds held amounted to \$37,458.12 which comprised investments in gilt-edged securities of \$35,820 and \$1,638.12 cash at bank. The Auditor-General of N.S.W. reported that an examination of the accounts was satisfactory.

Following the resignation of Mr M. G. Heath as a non-official trustee, the vacancy was filled by Mr A. R. Doolin of North Star. There was one ordinary and one annual meeting held during the year.

Professor J. M. Vincent, Head of the School of Microbiology at the University of New South Wales was chosen as the 1972 Farrer Memorial Medallist. The presentation ceremony was held in the Great Hall of the University of Sydney on 14th September, 1972, at a function organized in association with the New South Wales Branch of the Australian Institute of Agricultural Science. A receptive audience heard Professor Vincent deliver his oration under the title "Nitrogen from Microbes".

The 1972 Farrer Memorial Research Scholarship held by Mr R. A. Hare was extended for a period of 12 months to 27th February, 1974, to enable the scholar to continue his research into non-specific disease resistance to stem rust of wheat at the University of Sydney.

Royal Botanic Gardens and Government Domain Trust

A vacancy on the Trust created by the resignation of Dr J. S. Beard was filled by the incoming Director and Chief Botanist of the Royal Botanic Gardens, Dr L. A. S. Johnson.

Trustees met formally on two occasions during the year to determine matters of policy in relation to the parklands under their control.

By notification in the *Government Gazette* of 14th July, 1972, land at Mount Tomah donated by Mrs E. J. Brunet was reserved under the Crown Lands Consolidation Act for botanic garden purposes and the area was subsequently vested in trustees. Arrangements are in hand for development of the property as a cold climate annexe of the Royal Botanic Gardens.

MARKETING BOARDS AND POLLS

The Division of Marketing and Economics is responsible for the administration of the Marketing of Primary Products Act and in particular for the conduct of polls arising from that Act.

Marketing Boards in operation at the beginning of the year were the *Egg, Lemon, Rice, Tobacco Leaf, Wine Grapes, Central Coast (N.S.W.) Citrus, Grain Sorghum, Barley and Oats Marketing Boards* and the *Citrus Fruits (excluding Lemons) Marketing Board for the Wentworth Shire and that portion of the Balranald Shire within the County of Taila*. The *Oil Seed Marketing Board* came into existence on 11th May, 1973 and by a poll conducted on 15th November, 1972, the producers of sheep meats voted in favour of the constitution of a *Sheep Meats Marketing Board*. Action is proceeding for a poll for the election of producer representatives to the last-mentioned Board.

Polls under the Marketing of Primary Products Act

Seven polls were conducted during the year under this Act. These were:

1. Constitution poll: *Oilseeds Marketing Board for the State of New South Wales* (28th July, 1972).
2. Poll on the question whether an additional area shall be incorporated in the area controlled by the *Central Coast (N.S.W.) Citrus Marketing Board* (27th September, 1972).
3. Poll on the question whether an additional area shall be incorporated in the area controlled by the *Citrus Fruits (excluding Lemons) Marketing Board for the Wentworth Shire and that portion of the Balranald Shire within the County of Taila* (27th September, 1972).
4. Constitution poll: *Sheep Meats Marketing Board for the State of New South Wales* (11th November, 1972).
5. Poll on the question of whether an additional area shall be incorporated in the area controlled by the *Wine Grapes Marketing Board for the Shires of Leeton, Wade and Carrathool* (15th December, 1972).
6. Triennial election of two producers representatives to the *Citrus Fruits (excluding Lemons) Marketing Board for the Wentworth Shire and that portion of the Balranald Shire within the County of Taila* (1st March, 1973).
7. Election of five producers representatives to the *Oilseeds Marketing Board for the State of New South Wales* (30th March, 1973).

The poll referred to in paragraph 4 was conducted by the Electoral Commissioner of New South Wales. The polls referred to in paragraphs 1, 4 and 5 resulted in an affirmative vote; those referred to in paragraphs 2 and 3 resulted in a negative vote.

Other Polls Conducted

A referendum under the Egg Industry Stabilisation Act, 1971, for the constitution of a Poultry Farmers Licensing Committee (11th August, 1972).

The triennial election of six State Councillors to the Potato Growers Association of New South Wales (25th October, 1972).

The triennial election of four producer representatives to the Dried Fruits Board of New South Wales (6th February, 1973).

The referendum to constitute a Poultry Farmers Licensing Committee resulted in an affirmative vote.

LEGAL BRANCH

Acts

The Branch was involved in the work leading to the enactment of the following legislation:

Potato Growers Licensing (Amendment) Act, 1972: The Principal Act requires a license for the use of land for the production of potatoes. This Act reduces the minimum area for which a license is required from 1 acre to one quarter of an acre.

Swine Compensation Taxation (Repeal) Act, 1972: This Act repealed the Swine Compensation Taxation Act thereby removing the tax imposed, in the form of stamp duty, on the delivery of pigs to an abattoir for slaughter, to provide revenue for the payment of compensation for pigs destroyed or carcasses condemned on account of disease.

Swine Compensation (Amendment) Act, 1972: This Act removed from the Principal Act the machinery provisions ancillary to the collection of the tax referred to in the preceding paragraph and also provided for surplus funds at the credit of the Swine Compensation Fund to be used for research into pig diseases.

Wheat Quotas Act, 1972: Provided for allocation of wheat quotas to wheat-growers in N.S.W. for the 1972-3 wheat season.

Egg Industry Stabilization (Amendment) Act, 1972: Resolves certain anomalies in the implementation of the hen quota scheme provided for under the Principal Act and confers additional powers on the licensing committee dealing with the allocation of hen quotas.

Dairy Industry (Amendment) Act, 1973: Increased the State table margarine quota from 9,000 tons to 10,800 tons and provides for labelling of different categories of margarine.

Grain Elevators (Amendment) Act, 1973: Widens the authority of the Grain Elevators Board to cover the storage and handling of seed and products manufactured from plant material as well as wheat and grains other than wheat.

Regulations, Proclamations, and Notifications

During the year work leading to the gazettal of thirty-four sets of regulations, ninety-eight proclamations and seventy-eight notifications was undertaken.

Loans

Nineteen Executive Council Minutes were prepared for loans proposed on behalf of the Grain Elevators Board and the Sydney Farm Produce Market Authority.

Prosecutions

One hundred and ninety-eight informations were prepared under Acts administered by the Department.

Registrations

Registrations effected during 1971-2 and 1972-3 are compared numerically as follows:

	1971-2	1972-3
Farm Produce Agents	272	250
Veterinary Surgeons	937	1014

Arbitrations under the Agricultural Holdings Act, 1941

During the year, three matters were referred to arbitration and one of these has been heard by an agricultural committee.

AUTOMATIC DATA PROCESSING

The ADP Section provides a data processing service for Divisions and Branches of the Department. It is responsible for the initial investigations which determine whether the use of ADP techniques is warranted in connection with an activity or project, and if approved, for designing, developing and implementing the ADP system for that project. It also provides assistance and advice on computer programs and programming, data preparation and use of computer facilities generally.

The main activities during the year were in connection with the following projects:

Dairy Herd Recording

This was the first ADP system to be implemented in the Department, in 1963. It provides for recording annually, milk and butterfat production and other information for about 100,000 cows and for assessing the breeding worth of sires whose daughters are recording under the scheme.

In May, 1973, changes in the rules governing herd recording necessitated some re-programming of the ADP system. The main changes were in respect of interval between samplings and the method of calculating milk and butterfat yield at each sampling.

At the same time a new method of preparing data for input to the system was introduced. The technique involves the use of a machine called an optical character reader, which reads handwritten data and transfers the data to magnetic tape for subsequent processing through the ADP system. The use of this technique commenced in October, 1972, as a pilot trial in a small number of herds. From 1st May, 1973, it is being used for all herds.

Australian Wheat Collection

An ADP system for recording and retrieving information in connection with a collection of about 16,000 wheats in the Australian Wheat Collection is being implemented. The Collection is located at Tamworth Agricultural Research Centre.

A computer programme developed in the U.S.A. especially for taxonomic information retrieval is being used for this work. The programme was obtained by the Department's ADP systems officer on a visit to the U.S.A. in August/September, 1972.

Some data relating to about 1,500 wheats have been stored on magnetic disc. Capture of the remaining data is continuing.

Plant Pathology Herbarium Collection

An information system in connection with a collection of over 23,000 specimens of plant diseases maintained in the Biology Branch commenced operating in 1972.

The system provides for the printing of indexes and catalogues in various orders, showing details of all specimens in the collection and for retrieving and printing information as may be required from time to time.

Data for about 6,000 specimens have been stored on magnetic tape to date.

The first two sets of index cards, one sequenced on host and the other on pathogen, have been printed.

Beef Cattle Performance Recording

The ADP system for beef cattle performance records, which commenced operating in 1968, had its final run in December, 1972. Records are now being processed, as a national recording scheme, by the University of New England.

Fruit Tree Census

In this system, data relating to the number, acreage and age of fruit trees, vines and berries growing in N.S.W. are stored on magnetic tape and updated annually.

Calculation of statistics of plantings as at 31st December, 1972, and reporting results was completed in June, 1973. This was the fourth census to be carried out by computer since the ADP system was developed for this work in 1970.

Projects Under Consideration

Projects under consideration include information systems in connection with the registration of pesticides and the scheme for eradication of tuberculosis and brucellosis in cattle.

STAFF DEVELOPMENT

For several reasons, 1972–3 was a very important year for staff development in the Department. First and foremost, the appointment of a clerk class B and a typist, effectively freed the Staff Development Officer from administrative duties and allowed him to begin developing a range of much needed training programmes. Secondly, the Public Service Board's initiative in formulating a human resource development (H.R.D.) policy gave purpose and direction to the work of the section. Throughout the year the Staff Development Committee, the top co-ordinating committee for training in the Department, worked intensively on H.R.D. and through a series of sub-committees set the scene for an entirely new approach to staff development. The fruits of these labours will become evident by December, 1973.

The third factor, without which the other two factors would mean little, is the attitude towards training taken by officers in the Department. Current interest in the subject of staff development is very high and most Divisions are driving actively towards developing their own staff development programmes.

At the individual level, the number of officers engaged in private study is steadily increasing. During the year, twelve officers were awarded Public Service Board part-time scholarships bringing to forty-two the total number of active scholarships being undertaken. Nine officers are expected to graduate this year. Eighteen officers applied for Public Service Board Fellowships, but as at 30th June, 1973, the successful candidates had not been named.

In all, 115 officers receive departmental sponsorship in their part-time studies.

SAFETY

During the year, the Department proceeded with the further development and implementation of programmes of accident prevention and safety training in accordance with guidelines laid down by the Inter-Departmental Committee on Occupational Safety and Occupational Health. The Departmental Safety Committee met at regular intervals and the Safety Officer (Mr F. J. Field) was actively engaged in safety education and promotion; accident investigations and advisory work on safety measures.

Ten job safety courses were conducted over the period at various departmental institutions throughout the State involving one hundred and two people holding supervisory positions and arrangements have been made for formal certificates to be issued to officers who have undertaken job safety training. Special talks were delivered to casual labouring staff employed under the Metropolitan Unemployment Relief Scheme.

Apart from the Departmental Safety Committee, six local safety committees have been formed at departmental institutions and two others are in the process of being formed. Other institutions are reluctant to form committees because they consider that by reason of their limited numbers or because of their low accident record they are unnecessary.

The accident record showed a sharp increase in two areas, namely, among the casual labouring staff under the Metropolitan Unemployment Relief Scheme, who appeared to be far more "accident-prone" than regular staff and within the meat inspection service. Injuries to meat inspectors are mainly caused by knives and, to combat this, safety knives and metal mesh gloves are to be introduced on a trial basis.

One of the biggest problems involving motor vehicles (especially those used west of the Range and in certain other areas) is the potential hazard of a shattered windshield. Some vehicles have had as many as six windscreens replaced during their life of approximately 30,000 miles. A recommendation has been made by the Departmental Safety Committee that all vehicles located in known hazardous areas be fitted with laminated screens.

The report of several cases of illness caused mainly by bovine diseases, and involving people working around cattle or within the meat inspection service has led to a recommendation that the incidence of bovine diseases be brought before the Inter-Departmental Committee on Zoonoses.

ORGANIZATION AND METHODS SECTION

During the year reports were submitted on two surveys from which nine recommendations emanated. Recommendations from the survey of requisitioning procedures resulted in the introduction of increased delegated authority to approve requisitions and a reduction in the number of steps required in the processing of requisitions. The survey of the Agricultural Research Station, Tamworth, provided relief to professional officers of clerical duties, new procedures for the keeping of commitments, and a new filing index.

A pilot study was commenced in the field of technical information retrieval within the South Coast and Tablelands region which has attracted interest from the Tasmanian and Western Australian Departments of Agriculture and the Department of the Navy.

A pilot study was also commenced with a view to introducing a uniform filing index within the Department. The regional officers at Gunnedah and Tamworth are introducing the system and the results to date are very encouraging.

The analyst and methods officers have also been involved in an investigation of the working environment of staff at the Fibre Testing Laboratory, Rydalmere; variations to the records systems at the Royal Botanic Gardens and the Meat Inspection Service, Homebush; procedures for issuing licenses under the Horticultural Stock and Nurseries Act; utilization of typing staff at the Royal Botanic Gardens and the introduction of new forms for pastures protection board permits.

The analyst has been involved for the major part of his time in the planning and investigation of requirements for the proposed movement of the head office staff of the Department to the Rawson Place Government Offices.

Again, the year has been a particularly busy one for the O. & M. section in its role of Machines Committee and Forms Committee. During the year more than 200 various office aids have been or are in the process of being acquired for use by officers of the Department.

STATE OFFICE BLOCK LIBRARY

Central library: Seven officers resigned during the year and two were transferred to the Library of New South Wales. As at 30th June, 1973, there were two vacancies in a staff of thirteen.

Branch libraries: An additional library assistant was appointed to Hawkesbury Agricultural College.

No satisfactory applicant was found for the position of library assistant at Wagga Agricultural College and the position is to be advertised again.

Further recommendations have been made for additional assistance at the Royal Botanic Gardens, but so far without result.

Librarians have been appointed to Orange Agricultural College and Yanco Agricultural College and Research Station.

A member of the State Office Block Library supervised the move into the new libraries at Yanco and Trangie Agricultural Research Station.

Funds: Funds for the purchase of books and periodicals were available as follows:

Consolidated Revenue Fund	\$35,100
Unmatched Library Grant	\$13,960
Commonwealth Extension Services Grant	\$27,500
	<u>\$76,560</u>

Orders placed: A total of 3,592 items as against 3,125 for 1971-2 were ordered or covered by requisitions through local suppliers or the New South Wales Government Offices in London.

For other Departments 123 items were ordered for Department of Public Works; 58 for Premier's Department and 8 for the Department of Local Government.

Central library accessions: 27,719 items were accessioned as against 27,451 for 1971-2. The 27,719 items comprised 1,672 books; 16,529 new periodical issues; 44 new periodical titles; 1,078 annuals and 8,396 pamphlets. The 8,396 pamphlets comprised 2,640 in series; 530 catalogued; 333 distributed by subject; 1,094 parliamentary papers and 3,799 miscellaneous. The average rate of items accessioned was 533.

Central library loans: Loans totalled 36,377 as against 47,561 in 1971-2, reflecting the marked increase in photocopying services. The 36,377 comprised 25,901 periodical issues circulated (average 498 per week) and 10,476 miscellaneous loans. Of the 10,476 miscellaneous loans, there were 8,352 to Departmental officers; 1,204 to libraries of other institutions, while 920 were borrowed from other libraries, including 501 photocopies supplied in lieu of loans.

Branch library loans: Total loans were 42,253. Individual loans were Hawkesbury Agricultural College 6,072; Veterinary Research Station 15,189; Agricultural Research Institute, Wagga 1,300; Wagga Agricultural College 4,357; Royal Botanic Gardens 2,180; Biological and Chemical Research Institute 12,490.

Library bulletins: Twelve bulletins were compiled and distributed totalling 622 pages and 4,585 items as against twelve bulletins totalling 621 pages and 4,808 items in 1971-2.

Literature searches: Bibliographies produced by literature searches for Departmental officers were listed regularly in the Library Bulletin and in the period under review forty-eight searches were listed, eight fewer than in 1971-2.

Photocopying service: The total number of jobs arranged through the Document Reproduction Centre was 2,823 involving 16,525 sheets as against 1,611 jobs involving 9,801 sheets in 1971-2.

New exchanges: Exchanges were arranged for agricultural literature from institutions in Brazil, New Zealand, South Africa and West Germany.

Translation services: Departmental officers were supplied with twenty-six translations from the following languages: Danish, French, German, Italian, Japanese, Portuguese, Russian, Spanish and Swedish.

PESTICIDES REGISTRATION SECTION

This section was set up during the year as a separate unit within Central Administration. At the same time the office of Registrar of Pesticides was constituted and the occupant of that office, Mr D. E. Weedman, is in charge of the section which comprises one male and two female clerical officers.

Mr Weedman is the executive officer responsible for the administration of the Pest Destroyers Act and is also executive officer to the Pest Destroyers Committee which deals with the applications for the registration of pesticides under the Act and associated policy matters. A report on activities with respect to pesticide registration during the year and projected legislation is dealt with in section 6.1 Regulatory and Technical Services: Plants and Plant Products.

STAFF AND TRAINEES

Appointments: The following appointments of senior officers were made during the year: Mr D. E. Weedman, appointed Registrar of Pesticides; Mr B. C. Allman, formerly of the Accounts Branch, Forestry Commission, appointed Assistant Accountant; Mr B. Waters and Mr J. Ong, appointed Assistant Legal Officers; Mr J. P. Whelan, appointed Personnel Officer and Mr P. Jarman, appointed Minister's Secretary.

Deaths: It is regrettably recorded that Mr J. J. Simes, Assistant Accountant, died in April, 1973, after a short illness and Mr A. Townson, Personnel Officer, was tragically drowned at Kurnell.

Retirement: Mr J. J. McCormick, Assistant Secretary, entered on long service leave prior to retirement in January, 1973. He joined the Department on leaving school in 1935 and after a distinguished career as a clerical officer of the Department he was appointed Assistant Secretary in 1968. He left his mark as a most knowledgeable and highly capable administrator.

Overseas travel and post-graduate study: The numbers of officers engaged on overseas leave or post-graduate study during the year were as follows: absent overseas on official travel, thirty-five; on post-graduate study overseas, twenty-three; on full-time postgraduate study in Australia, forty-eight.

Trainees: During the year, 58 trainees out of an overall strength of 133, graduated from universities and agricultural colleges. Because of limited vacancies attributable in part to a stabilizing trend in professional employment not all of the trainees could be absorbed into established positions and a number have been retained in a supernumerary capacity pending the occurrence of vacancies in the establishment. In consequence of the changing employment situation only nine trainees were recruited in 1973 and the current establishment for trainees is 82.

DEPARTMENTAL STAFF ESTABLISHMENT AS AT 30TH JUNE, 1973

Division/ Branch	Professional					General and Ministerial			Adminis- trative and Clerical	Total
	Res	Ext	Educ	Admin	Total	Reg	Other	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Central Administration	..	..	..	10	10	..	31	31	116	157
Extension Services	3	3	..	35	41	..	115	115	76	232
Animal Industry	81	139	8	25	253	983	167	1,150	53	1,456
Dairying	8	44	9	15	76	..	162	162	8	246
Horticulture	21	32	2	15	70	135	11	146	16	232

DEPARTMENTAL STAFF ESTABLISHMENT AS AT 30TH JUNE, 1973 —continued

Plant Industry	70	71	..	26	167	23	23	46	17	230
Biological and Chemical Research Institute	92	..	..	7	99	..	94	94	7	200
Biometrical	13	..	..	2	15	..	2	2	4	21
Marketing and Economics	39	..	..	7	46	..	16	16	8	70
Research Services	35	7	..	34	76	..	451	451	38	565
Royal Botanic Gardens and National Herbarium	12	..	..	2	14	..	154	154	3	171
Agricultural Education	..	..	80	50	130	..	421	421	39	590
Totals	374	296	99	228	997	1,141	1,647	2,788	385	4,170

Explanatory notes:

- (1) Professional officers whose time is predominantly occupied on research projects and laboratory diagnostic services.
- (2) Professional officers whose time is predominantly occupied on extension to farmers
- (3) Professional officers whose time is predominantly occupied on agricultural education.
- (4) Professional officers whose time is predominantly occupied on administrative or other activities.
- (5) Does not include eighty-two agricultural college and university trainees employed by the Department.
- (6) General Division and ministerial staff whose time is predominantly occupied on regulatory activities.
- (7) Other General Division and ministerial staff.
- (8) Typists, office assistants, and clerical assistants are included in the General Division figures.
- (9) Only accounting machine operators, stenographers and male clerical positions are included in these figures.
- (10) Trainees are not included.

DIVISION OF EXTENSION SERVICES

FUNCTIONS

Administration and Supervision

- Administer, supervise and co-ordinate the Department's extension services through the nine agricultural regions.
- Administer, supervise and maintain the Department of Agriculture's offices in regions (sixty-one offices) including all clerical personnel and some general division personnel, such as field assistants.
- The administration of the Commonwealth Extension Services Grant.

Editorial

- Processing of material for publications; preparing it for submission to the Government Printer or for release to the news media.
- Distribute agricultural information through booklets and leaflets contained in the Department's range of approximately 1,400 miscellaneous publications.
- Supply specialist advice to home gardeners not adequately met by the literature distribution service.

Extension Methods Training

- Develop skills of extension workers in their use of extension methods and their knowledge and understanding of the extension process.

Group Extension

- Provide organizational help to the Agricultural Bureau and promote group extension activities through this and other rural groups, including extension services for rural women.

Audio Visual Aids

- Provide audio visual aids equipment for use by extension workers and develop extension workers' skills in their use of aids, including radio and television.

Extension Research/Evaluation

- Review, report and make recommendations on matters relating to the operation, stimulation, organization and co-ordination of the Department's extension services.
- Encourage and assist extension workers to measure and evaluate the effectiveness of their extension efforts.

Extension Research Liaison

- Promote liaison with research workers in government, universities and commerce.

STAFF

Vacancies

The Division is now almost at full staff strength, the only significant vacancy being that of Assistant Editor of Publications.

There has been a rapid turnover of editorial staff through the year causing some disruption of the operations of the editorial section.

Severances and Appointments

Obituary: The Division records with sadness the tragic accidental death in June, 1973, of the Editor of Publications, W. R. (Wal) Turner. He was fifty-six.

Wal had a true feeling for the land, having been reared in the country and having spent his early journalistic working life on a country newspaper. He served with the 2nd AIF in England, the Middle East and the Pacific.

Following service with the Public Works Department in Sydney, he joined the Department of Agriculture as an Editorial Assistant in 1955. He was promoted to the position of Assistant Editor in 1961 and Editor in 1962.

Wal's remarkable fund of knowledge and journalistic expertise were of immense value to the Department and his bright personality and sympathetic guidance will long be missed.

The more important appointments during the year were: G. F. Smith, B.A.Ag. (Cambridge) and M.S. (Journalism), (Illinois) to the newly-created position of Principal Extension Officer (Publications and Information); A. J. Boyle, H.D.A., B.A., Principal Extension Officer, Head Office; G. M. Yabsley, B.A., Assistant Principal Extension Officer, Maitland.

Overseas visits

At the request of the Department of Foreign Affairs, J. N. Potter, Principal Extension Officer (Extension Research and Evaluation), attended a meeting convened by O.E.C.D. in Paris concerned with the evaluation of agricultural advisory services.

G. M. Yabsley, while serving as District Agronomist, Murwillumbah, was selected for a study tour to Alberta, Canada, under a grant from the Commonwealth Extension Services Grant to observe and study in depth extension methods, particularly farm management extension. He was attached to the regional headquarters of the Alberta Department of Agriculture at Calgary, and attended various schools, courses and conferences.

Conferences and Meetings

Appropriate members of the Division attended the following meetings:

- The 48th Annual State Conference of the Agricultural Bureau (Bathurst, 10–13th July, 1972).
- Conference of Regional Supervisors (Sydney, 25–28th July, 1972).
- Training in Extension Methods Workshop (Mona Vale, 19th–23rd February, 1973).
- Extension Services Reorganization — Queensland Department of Primary Industries (April, 1973).
- Australian Agricultural Extension Conference (Glenormiston Agricultural College, Noorat, Victoria, 14–18th May, 1973).

Committees

Members of the Division at head office and Regional Supervisors were represented on a considerable number of committees during the year. Amongst these were:

- The Advisory Board of Adult Education.
- Metric Conversion Agricultural Information Sector Committee.
- Agricultural Bureau Executive Council.
- Rural Youth State Council.
- Regional Advisory Committees.
- Technical College Advisory Committees.
- Irrigation Research and Extension Committee.
- A number of Agricultural Research and Extension Committees at regional level.

During the year inter-departmental committees on Rural Adjustment were created in all regions. Regional Supervisors were appointed chairman/conveners of these committees. Additionally, most Regional Supervisors were appointed members of the newly-created Regional Advisory Councils. These councils were formed with the creation of the new standard regional boundaries. They replace the old Development Committees.

Staff Training

The Regional Supervisor, North Western Region, attended the Number 25 Government Administrative Staff course at the University of New South Wales Institute of Administration.

Training of Overseas Personnel

Officers of the Division have contributed segments on agricultural extension to a number of courses for international fellows studying in Australia. These courses were arranged by the Commonwealth Department of Foreign Affairs in conjunction with State Departments of Agriculture, universities and appropriate institutions.

Additionally, head office staff and Regional Supervisors have arranged and participated in training experiences and/or study tours for various groups and individuals visiting New South Wales.

NEW DEVELOPMENTS

Regional Boundaries

The Public Service Board has given approval for this Department to proceed to adjust its regional boundaries to conform with the common regional boundaries for all government departments and instrumentalities. There will be eight agricultural regions instead of nine and there is a major variation involving regions five and six.

Plans are proceeding for the changes to be effected, such as relocation of district offices and personnel, but before they are implemented the approval of the Cabinet subcommittee dealing with the matter will be required.

Formation of Regional Advisory Councils

In association with the decision to establish common regional boundaries for all government departments in New South Wales, Regional Advisory Councils have been established. These will replace the Regional Development Committees associated with the former regional system. Most of the Regional Supervisors have been appointed as members of the new Regional Advisory Councils.

Regional Inter-Departmental Committees on Rural Adjustment

As forecast in the report for 1971-2, interdepartmental committees on rural adjustment were established in all regions. In each instance, Regional Supervisors were appointed chairman/conveners. In addition to the Department of Agriculture, other government departments represented on the committees are: Education, Technical Education, Conservation, Decentralization and Development, and the Vocational Guidance Section of the Department of Labour and Industry.

Country Offices

Towards the latter end of the year, a new office was established at Yass. Accommodation for this office is temporarily in the Yass court house. It is not regarded as being satisfactory and efforts will be made to find more suitable quarters.

Office Equipment

Acquisition of additional office equipment has helped to improve office efficiency at a number of country centres. The equipment includes duplicators, desk calculators, collators and electric stapling machines.

DIVISION OF ANIMAL INDUSTRY

FUNCTIONS

The Division of Animal Industry is responsible for research, extension and regulatory control relating to livestock production and health. Research is conducted into diseases of all classes of livestock and into the breeding, nutrition and management of sheep, beef cattle, pigs, poultry and bees, together with nutrition of dairy cattle. Noxious animal research is also undertaken.

Extension is directed at educating stockowners in procedures aimed at improving efficiency of management and nutrition of sheep, beef cattle, pigs, poultry, Angora goats, and bees, together with methods of preventing and controlling diseases in these species and also dairy cattle. Regulatory control is exercised over scheduled diseases of livestock and bees, the identification of livestock and the control of noxious animals and plague locusts.

The Division is responsible for inspection of meat for local consumption at the State's major abattoirs. It administers Government drought relief, travelling stock reserves, public watering places and the registration of stock foods and medicines. On behalf of the Commonwealth Government, the Division administers the sections of the Quarantine Act relating to the import and export of animals and animal products.

STAFF

Vacancies

Four veterinary officers resigned and at the end of the year there were six vacancies for veterinary officers for which there were no available appointees. The vacancies caused significant difficulties in view of the expansion of the Division's disease control programme.

Staff Changes

Mr D. A. Dickinson, from Assistant Principal Veterinary Officer (Exotic Diseases) to Deputy Chairman, Board of Tick Control, Lismore (new position); Mr B. W. Bootes, from Assistant Principal Veterinary Officer (Meat Inspection) to Assistant Principal Veterinary Officer (Exotic Diseases); Mr W. Mayger, from Veterinary Research officer, to Assistant Principal Veterinary Officer (Meat Inspection); Mr S. H. Yeend, to Senior Clerk.

The death occurred of Mr C. C. Blumer, who retired in 1960 from the position of Chief, Division of Animal Industry. He had previously held the positions of District Veterinary Officer, Armidale, Senior Veterinary Officer, Chairman, Board of Tick Control and Deputy Chief, Division of Animal Industry.

Overseas Visits

Mr G. C. Carter, Veterinary Officer, to the United Kingdom to supervise the importation of the first group of horses to be consigned to Australia by air, and to investigate the design and management of quarantine facilities for dogs and cats.

Mr P. D. Claxton, Veterinary Research Officer, to New Zealand to investigate laboratory organization and techniques used in the brucellosis eradication campaign, and to study other aspects of the campaign.

Mr A. R. Godlee, Assistant Principal Livestock Officer, (Sheep and Wool) and Mr B. Ferguson, District Livestock Officer (Sheep and Wool), to India with a flight of Corriedale sheep concerning a Colombo Plan project in that country.

Mr R. E. Freer, Senior Livestock Officer, (Beef Cattle), to the U.S.A., Canada, United Kingdom, France, Switzerland and West Germany under a Public Service Board scholarship, to study the application of overseas breeding techniques to the Australian cattle industry.

Dr P. J. Holst, Livestock Research Officer, to New Zealand to investigate research conducted by the New Zealand Ministry of Agriculture and Fisheries in sheepbreeding.

Mr I. R. Littlejohns, Special Veterinary Research Officer, to the United Kingdom to study methods used in controlling an outbreak of swine vesicular disease in the field and at the Animal Virus Research Institute, Pirbright.

Mr T. D. Mitchell, Livestock Officer (Sheep and Wool), to the United Kingdom, United States and South Africa, to study mohair and meat producing goats.

Conferences

Mr A. A. Clemson, Principal Livestock Officer (Apiculture) and other livestock officers (Apiculture) attended the first Australian Bee Congress at Broadbeach, Queensland, held under the auspices of Apimondia, the World Federation of Beekeepers' Associations.

Mr D. G. Christie, Principal Veterinary Officer was the official departmental representative at the Annual Conference of the Australian Veterinary Association in Darwin.

Dr I. J. Lewis, Director, Cattle Tick Research Station and Dr J. Nolan, Research Scientist, attended the 14th International Entomology Congress in Canberra. Dr Nolan presented a paper.

Mr P. McInnes, Director of Animal Production Research, the principal livestock officers and nine other livestock research officers and livestock officers attended the Third World Conference on Animal Production in Melbourne. Five abstracts were contributed, with livestock research officers as senior authors.

Mr L. M. Russell, Principal Livestock Officer (Pigs), and Mr A. R. Godlee, Assistant Principal Livestock Officer (Sheep and Wool), attended the National Agricultural Outlook Conference in Canberra.

Committees

The Division of Animal Industry was represented on the following committees:

- Board of Veterinary Surgeons.
- Stock Medicines Board.
- N.S.W. Meat Industry Authority.
- Dairy Industry Artificial Breeding Advisory Board.
- Poisons Advisory Committee.
- Commonwealth Therapeutic Goods Standards Committee.
- Cattle Tick Control Commission.
- Commonwealth and States Veterinary Committee.
- Veterinary Public Health Committee of the National Health and Medical Research Council.
- Standing Committee on Drought Relief.
- Rabbit Control Advisory Committee.
- Plague Locust Advisory Committee.
- Pastures Protection Board Council of Advice.
- Poultry Advisory Board.

Assistance to Overseas Countries and Personnel

The Division is represented on a technical advisory committee which provides technical advice for two Colombo Plan sheep projects, one in India and the other in Korea, established by the Department of Foreign Affairs. Each project aims to run a sheep farm on Australian lines designed to meet local requirements, and consignments of sheep have been selected and forwarded to the two countries for the establishment of the farms. Some environmental problems have been encountered in the Indian project and attempts are being made to correct this situation.

A training course in disease control was conducted for eighteen veterinarians from various countries in Asia and Africa. Preparations were made for a course in sheep husbandry to be held in 1973-4 for livestock officers from similar countries.

Eleven research workers from overseas countries visited the Veterinary Research Station, Glenfield. Mr Lam Mai, Veterinarian, Malaysia, was employed for 12 months as Veterinary Inspector, Condobolin, as part of training prior to returning to his own country. Assistance was given to seven students from India and two from Pakistan.

NEW DEVELOPMENTS

An additional \$500,000 was made available by the Australian Government to New South Wales to enable an accelerated programme for the tuberculosis campaign to be implemented. As a result, nineteen pastures protection districts in the Western Division and adjoining Victoria were declared protected areas for this disease and a programme of testing instituted.

The Australian Government increased its rate of contribution to the States for tuberculosis and brucellosis campaigns above the previous dollar for dollar basis. For 1973-4, the figure promised is \$4.8 million representing a 33½ per cent increase on the 1972-3 amount. For 1974-5, \$6.4 million is promised provided the States maintain their expenditure of 1973-4 plus 10 per cent.

Special staff have been appointed to twenty-six major abattoirs to monitor slaughter cattle for tuberculosis and brucellosis. Such is the progress being made that it is anticipated that five pastures protection districts may be eligible for accreditation as tuberculosis-free areas during 1973-4.

The Australian Government has set up a national compensation scheme for cattle slaughtered for tuberculosis. As New South Wales already has such a scheme, the Commonwealth contribution will be a subsidy to this scheme.

As part of the brucellosis campaign, plans are being prepared for the construction of three special serology processing laboratories with a potential capacity for annually testing 2 million samples for this disease. Preparations are also in hand for a test and slaughter programme for this disease to commence on the North Coast as soon as laboratory facilities and field staff are available, probably during 1974-5.

Construction proceeded to near finality on a new veterinary laboratory at Wagga, representing the fourth such laboratory in New South Wales. An innovation is the accommodation of both the laboratory facilities and the District Veterinary Officer and his staff in the one building complex, which has been designated the Regional Veterinary Centre.

A base radio communication station was established at the office of the District Veterinary Officer which will significantly improve efficiency in an area of remote travel.

The Swine Compensation (Taxation) Act, under which a levy was made on all swine slaughtered was repealed and henceforth, interest on the fund's balance will be the sole source of revenue for swine compensation payments.

LIVESTOCK NUMBERS

As at 30th June, 1973, there were approximately 25,500 sheep on departmental properties, most being used for research purposes. The value of wool and sheep sold was approximately \$212,000. Beef cattle numbered 5,381 head and the sale of beef bulls realized \$11,660.

Twenty-one stud pigs were sold for \$1,470 and the sale of 997 non-stud pigs yielded \$29,438. Twelve pure bred Arab horses were sold for \$11,690.

DIVISION OF DAIRYING

FUNCTIONS

The Division of Dairying has three functions:

- Extension
- Regulatory
- Research

It is responsible for guiding the industry through all phases of farm production and product manufacture to the point of marketing.

Aims in Extension

- Improve animal husbandry techniques.
- Improve stock quality and production through its herd improvement scheme.
- Improve milking shed management and machine efficiency.
- Provide advice on farm business management.
- Ensure production of high quality milk, cream and manufactured dairy products.

Regulatory

Responsible for administering the Dairy Industry Act and certain provisions of the New South Wales Pure Food Act which are designed to:

- Safeguard farmers.
- Enforce prescribed product standards.
- Ensure satisfactory standards of hygiene at farm and factory.
- Examine and issue certificates of competency for factory personnel.
- Register dairy produce factories and stores.
- Check grade and test milk and cream.

Research

Carry out research on new and existing dairy foods, sanitizers, milking machines, mastitis control, herd recording, nutrition and genetics.

STAFF

Retirements and Resignations

Mr R. T. Laffan, Principal Dairy Officer (Milk Products) retired on 14th July, 1972, after 20 years service with the Division. He was first appointed to Byron Bay as a dairy officer in 1946. He was acting Principal Dairy Officer at Lismore in 1951 and was transferred to Orange as District Dairy Officer in 1953. He was transferred to Parramatta in 1967 and appointed Principal Dairy Officer (Milk Products) in 1972.

Mr G. E. Kent, Assistant Principal Dairy Officer (Butter), resigned in May 1973, after completing 26 years service with the Department, to take up dairy farming at Warwick, Queensland. Mr Kent was appointed as a dairy officer in 1947 at head office on the butter grading staff. He later served at Lismore and Casino as a dairy officer before being appointed District Dairy Officer at Wagga and later Bega. He was appointed Assistant Principal Dairy Officer (Butter) late in 1968 and served in that position until his resignation.

Appointments

Mr H. E. Silversides, Principal Dairy Officer (Hawkesbury Agricultural College) to Principal Dairy Officer (Milk Products) in July, 1972.

Mr C. M. Ubrihien, District Dairy Officer, Bega, to Assistant Principal Dairy Officer (Milk Products) in January, 1973.

Mr B. O. E. Calder, Assistant Principal Dairy Officer (Research) to Assistant Principal Dairy Officer (Extension) on 22nd January, 1973.

Mr D. G. Dunsmore, Dairy Officer (Research) to Acting Assistant Principal Dairy Officer (Research) on 16th May, 1973.

The position of Principal Dairy Officer (Herd Improvement) and Assistant Principal Dairy Officer (Herd Improvement) were reclassified from B Grade to A Grade and Messrs R. Auld and D. Heptonstall were respectively appointed to the positions as reclassified in May, 1973.

Deaths

Mr R. Gamsby, Assistant Principal Dairy Officer (Extension) in November, 1972.

Overseas Visit

The Chief of the Division completed a 7-week trip to Denmark, West Germany, Ireland, England and Scotland, in the course of which he attended a conference on equipment for the dairy industry; investigated herd improvement techniques; studied mastitis control programmes; sought information on dairy cattle infertility surveys and enquired about plans to stabilize the dairy industry in the E.E.C.

Mr D. B. Heptonstall, Assistant Principal Dairy Officer (Herd Improvement) was seconded to the Commonwealth Government for a period of 5 weeks to carry out a feasibility study in India on the results obtained from previous contributions of dairy cattle from Australia and to recommend means of maximizing the achievement of objectives from this form of foreign aid.

Committees

The Division was represented on the following bodies:

- Artificial Breeding Advisory Board—Dairy Industry Authority.
- Animal Production Committee of Standing Committee on Agriculture.
- Technical Sub-Committee on Dairy Cattle Production.
- Dairy Husbandry Research Foundation—University of Sydney.
- Pure Food Advisory Committee.
- Commonwealth and States Dairy Officers Committee—Standing Committee on Agriculture.
- Standards Association of Australia Executive Committee.
- Standards Association of Australia — Various Committees on dairy farm requisites and fittings.

Training of Overseas Personnel

Five trainees undergoing training under the Special Commonwealth African Assistance Plan and the South Pacific Aid Programme spent from 2 to 4 weeks working on dairyfarms in the Casino district. The trainees lived on the farm with the farmers who were selected by district staff.

The training of two trainees from Ceylon was supervised by the District Dairy Officer at Coffs Harbour.

NEW DEVELOPMENTS

The management of the dairy produce factory at Hawkesbury Agricultural College previously administered by the Division of Dairying has been taken over by the College.

N.S.W. Dairy Detergent Scheme

On 1st January, 1973, the N.S.W. Dairy Detergent Advisory Scheme was initiated. It is the agency through which samples of detergents are submitted for evaluation by the Commonwealth Laboratory on Dairy Detergents and Sanitizers and through which the results of the evaluations are disseminated to the dairy industry. Evaluations of samples submitted in response to the initial request were circularized in a bulletin to manufacturers, dairy factories and extension staff on 1st July, 1973. Provision has been made for publicity of the scheme, instruction of extension staff and for a quality control operation under which detergents classed as satisfactory are subject to 6-monthly check tests. The scheme is already having an effect on cleaning practices in the dairy industry and is resulting in a general upgrading of the quality of detergents and sanitizers marketed in the dairy industry.

NORTH COAST DAIRY FEED YEAR ASSISTANCE SCHEME

The scheme operates from the Hastings Shire along the coastal strip to the Queensland border. It commenced in October, 1966, operated for 5 years and was then revised and continued for a further 3 years commencing in October, 1971.

The scheme is based on the implementation of approved feed year programmes developed by the Department.

The participation of the majority of North Coast farmers in the scheme has resulted in considerable improvement in the productivity of farms and general economic benefit to the area.

In the revised scheme the assistance per farm is \$200, 1971–2; \$150, 1972–3; and \$100, 1973–4 with no limit on the acreage, provided the farmer spends a similar amount on the area to be treated.

Particulars of applications received during 1970–1 and 1971–2 are as follows:

Year (1st Oct.— 31st Sept.)	No. of Eligible Dairy Farms	No. Applying for Assistance	Percentage Applying	Average area applied for (ha)
1970–1	3,305	2,354	72	7.9
1971–2	2,472	1,904	77	16.3

DEPARTMENTAL DAIRY HERDS AND PRODUCTION

Dairy cattle studs are now maintained at four Agricultural Colleges, viz., Hawkesbury, Wagga, Yanco and C. B. Alexander Colleges.

Special matings have been made at all colleges for the continued breeding of young bulls for A.B. progeny testing. In this regard, semen from outstanding bulls, production proven in the U.K., has been used at Hawkesbury and Yanco Agricultural Colleges while semen from the top proven Jersey sires in New Zealand has been ordered for Wagga Agricultural College.

The demand for cattle from both stud and commercial breeders has continued from previous years. This applied particularly for Friesian cattle where a long waiting list still applies. Notable sales were made at the 1973 Royal Easter Show with one Friesian heifer realizing \$1,300 and one bull \$1,000.

Herd Production

The following are average production details of Departmental herds recorded under the Official Section of the Dairy Herd Improvement Programme:

	No. of cows	Milk (kg)	Test per cent	Butter fat (kg)	Calving Interval	
					Weeks	Cows
Hawkesbury Agricultural College – Friesians	54	6 049	3.7	225	58	46
C.B. Alexander Agricultural College – Friesians	16	4 589	3.6	167	57	16
– A.I.S.	20	3 739	4.3	159	60	9
Yanco Agricultural College – Guernseys	33	4 257	5.2	222	59	28
Wagga Agricultural College – Jerseys	64	3 611	4.8	175	54	51

Highest individual production was obtained by a Friesian cow from Hawkesbury Agricultural College with 8 369 kg milk, 4.1 per cent test, 346 kg butterfat. Two cows from Yanco Agricultural College exceeded 318 kg butterfat. In addition two cows from this college were breed class leaders.

Stock Sales

Fifty-five stud animals were sold for a total of \$13,290 as follows:

	Head	\$
Hawkesbury Agricultural College (Friesians)	26	7,790
Wagga Agricultural College (Jerseys)	12	2,020
Yanco Agricultural College (Guernseys)	5	1,125
Yanco Agricultural College (Friesians)	1	205
C. B. Alexander Agricultural College (Friesians)	7	1,545
C. B. Alexander Agricultural College (A.I.S.)	4	605

Artificial Breeding

Three jersey bulls from Wagga Agricultural College and one Guernsey bull from Yanco Agricultural College were selected for use by the Dairy Industry Authority Artificial Breeding Service.

Show Exhibits

Cattle from the four colleges were exhibited at their respective local shows, viz., Hawkesbury, Leeton, Maitland and Wagga, while teams from Hawkesbury and Yanco Agricultural Colleges were exhibited at the 1973 Royal Easter Show.

The most noteworthy success was obtained by the Friesian exhibit at the Royal Easter Show where the team, in a record class entry, was second in both the most successful breeder and exhibitor's classes.

DIVISION OF HORTICULTURE

FUNCTIONS

The Division of Horticulture is predominantly concerned with the production, marketing and export of fruit. Its research, extension and regulatory services are designed to assist the various industries involved in the growing and post-harvest handling of these fruit crops, including citrus and tropical fruits, wine, drying and table grapes, apples and pears, stone fruits, berries, nuts and canning and juice fruits.

Research

Research officers are located on research stations and laboratories on the North and Central Coast, Sydney, Central Tablelands, Murrumbidgee Irrigation Areas, and the Lower Murray River (Sunraysia). The research programme includes evaluation of rootstocks and scions, clonal selection, soil and irrigation management techniques, high density planting, hedging and topping, use of growth regulators for growth and cropping control (fruit set, thinning and maturity studies), mechanical harvesting, post-harvest rot control, fruit storage at low temperatures and in controlled atmospheres to delay senescence, control of storage disorders, waxing, packaging and transport. In addition, research into floricultural problems was commenced during the year.

Extension

Extension officers are located in the major fruit producing areas of the State with the primary objective of assisting the rural community, through education, to realize the maximum benefit from the use of available resources. The extension service is the essential link between research and commercial practice. It is the means by which growers are encouraged to use efficient methods and adopt improved techniques arising from research conducted by the Division and other organizations. Extension officers also assist in implementing the Plant Diseases Act.

Regulatory

Inspectors (Plant Diseases Act) enforce legislation concerned with the control and prevention of spread of pests and diseases of plants and plant products, packaging and marketing of fruit and vegetables, and the licensing of potato growers and of nurserymen and resellers of nursery stock. The Export and Import Branch of the Division administers on behalf of the Australian Government the Export Regulations under the Commerce (Trade Descriptions) Act in respect to the export of fruit, vegetables, plants, seeds, flour, wheat and other grains. Also on behalf of the Australian Government, the Branch administers the Quarantine Act in respect to plant quarantine, designed to prevent the introduction into Australia of further pests and diseases in plants.

STAFF

During the year all district fruit officer positions were filled and no vacant districts existed at the end of the year.

Overseas Visits

Mr J. R. Peterson, Fruit Officer (Research), who was awarded a Churchill Fellowship, visited Europe, the United Kingdom and the U.S.A. to study viticultural education and wine grape research.

Mr C. R. Turkington, Principal Fruit Officer (Viticulture), spent 3 months on a viticultural study tour through the U.S.A., western Europe, Greece and Turkey investigating new innovations and management practices, viticultural research and extension and the regulation of grape production in relation to market prospects.

Mr J. W. Turpin, Principal Fruit Officer (Citrus), attended, as citrus consultant, a technical meeting on tropical fruits conducted by the South Pacific Commission at Rarotonga, Cook Islands.

Mr B. Freeman, Fruit Officer (Research), attended the International Conference on Citriculture in Spain and visited South Africa, United Kingdom and U.S.A. to study aspects of citrus rind injury and wind protection.

Mr A. Catley, Scientific Officer (Regulatory), visited Indonesia under the Aid to Indonesia project to supervise the installation of equipment provided under the Aid programme for plant quarantine and to train Indonesian staff in its use.

Committees

The Division was represented on the following more significant Committees:

- Commonwealth and States Horticultural Committee.
- Commonwealth Fresh Fruit Disinfestation Committee.
- Committee for Co-ordination of Fruit and Vegetable Storage Research.
- CSIRO Vine Improvement Research Committee.
- Dried Fruits Research Committee.
- Commonwealth Grape Advisory Committee.
- M.I.A. Irrigation Research and Extension Committee.
- Central Coast Agricultural Research and Extension Committee.
- M.I.A. Fruit Fly Committee.
- Citrus Wastage Research Committee.
- Banana Marketing Control Committee.

Staff Development

A one week school for newly appointed inspectors (Plant Diseases Act) covered inspection and prosecution procedures, report preparation, press and radio publicity and Acts administered by the Division of Horticulture. In addition a weekly programme of lectures was conducted at the Export and Import Branch on technical aspects of regulatory work including pests and diseases of plants, timber and grains, marketing and grading of fruit and vegetables and documentary procedures. A number of inspectors also attended a course arranged for prosecuting officers which covered the collection and presentation of evidence and court procedures.

Assistance to Overseas Personnel

Two Indonesian plant quarantine officers undertook a period of training in plant quarantine procedures at the Export and Import Branch as part of the Aid to Indonesia programme.

Assistance was also provided to the following overseas visitors: A. N. Kasimatis, Extension Viticulturist, University of California, Davis; Dr G. E. Stembridge, Associate Professor, Clemson University, South Carolina; Mr Fumio Uto, Agricultural Extension Specialist, Kagoshima Prefectural Government, Japan.

NEW DEVELOPMENTS

Potatoes were the first of a series of commodities which will have grade standards imposed at the retail level under the provisions of the Plant Diseases Act.

A ministerial notification under the Plant Diseases Act in respect to fruit-fly control in the Shires of Narrandera, Leeton, Wade and Murrumbidgee resulted in growers, following consultation with departmental officers, initiating aerial spray baiting to combat the pest. This is believed to be the first occasion in Australia when this method of fruit-fly control has been employed.

The Potato Growers Licensing Act was amended to reduce to one quarter of an acre the minimum area for which a licence for the growing of potatoes is required under the Act.

Regulations were gazetted for the implementation of the Horticultural Stock and Nurseries Act; revising the provisions with respect to the grading of potatoes; prescribing procedures under the new legislation with respect to the remarking of packages bearing incorrect descriptions of grades of fruit and the levying of charges on consignors.

DIVISION OF PLANT INDUSTRY

FUNCTIONS

The functions of the Division of Plant Industry are mainly in the broad fields of agronomic research and extension. The Division also administers the Agricultural Seeds Act and for this purpose has a small regulatory staff of three inspectors, a seed testing laboratory and a staff of seed analysts.

The Division is responsible for research and extension within the whole range of field crops and pastures, vegetables, fodder conservation, seed production, weed control, irrigation and cloud seeding.

The research activities of the Division include plant breeding, plant introduction, investigation of cultural practices, times, rates, and methods of sowing, plant nutrition, species testing, establishment and management of pastures, irrigation techniques, seed production, fodder conservation and weed control.

Extension activity, or the dissemination of agricultural information, covers all aspects of crop production, farm management and pasture improvement.

STAFF

Vacancies

There were no significant vacancies in established positions during the year but there were three vacancies as at 30th June, one of these being the important newly-created position of Director of Agronomy Research.

Appointments and Severances

During the year one professional officer retired, seven resigned and six transferred to other Divisions but one of the latter had been in a super-numary position. Eleven graduating trainees were appointed, five for research and six for extension.

Overseas Visit

Mr F. W. Cutting, Principal Agronomist (Fibres and Oils), undertook a three months overseas study tour on oilseeds and cotton. The tour was financed by C.E.S.G. funds and permitted Mr Cutting to visit Japan, Russia, western Europe, Canada and the U.S.A. Whilst in France he attended the Fifth International Sunflower Conference in Clermont-Ferrand. Mr Cutting was also present at the American Soybean Association Convention held in Columbus, Ohio, U.S.A.

Committees

Some of the more important committees on which officers of the Division represent the Department are:

- Inter-Departmental Standing Committee for Aboriginal Welfare.
- State Committees on Flood and Bush Fire Relief.
- Guidelines Committee advising the Rural Assistance Board.
- Hunter Valley Conservation Trust.
- State Regional and Project Planning Committee (under the State Planning Authority of N.S.W.).
- N.S.W. Standing Advisory Committee on Wheat.
- State Wheat Improvement Committee.
- N.S.W. Advisory Committee on Wheat Production and Marketing.
- N.S.W. Wheat Standards Committee.
- Noxious Plants Advisory Committee.
- Australian Weeds Committee.
- N.S.W. and Central Tobacco Advisory Committees.
- N.S.W. Herbage Plant Liaison Committee.
- International Commission on Irrigation and Drainage—Australian National Committee.

Assistance to Overseas Personnel

International Training Course in Irrigation Planning and Practices: Officers of the Department in conjunction with those of other Commonwealth and State Departments were involved in the planning and conduct of the above course over the period 25th September–14th December, 1972. The course was attended by seventeen Fellows, fourteen from Colombo Plan countries and three from Africa.

Indo-Australian Sheep Breeding Centre, Hissar, India; Indo-Australian Dairy Cattle Breeding Centre, Hissar, India; Indo-Australian Dairy Cattle Breeding Centre, Barpetta, India: The Principal Agronomist (Seed Production), Principal Agronomist (Irrigation), Principal Livestock Officer (Sheep and Wool) and Assistant Principal Dairy Officer (Herd Improvement), constitute the Technical Advisory Committee, assisting the Department of Foreign Affairs to establish these farms under the Colombo Plan.

Sheep Demonstration Farm, Unbong, South Korea: The Principal Agronomist (Seed Production) and Principal Livestock Officer (Sheep and Wool) constitute the Technical Advisory Committee assisting the Department of Foreign Affairs in the establishment of this farm under the Colombo Plan.

NEW DEVELOPMENTS

A position of Director of Agronomy Research has been created in the Division of Plant Industry and, in future Principal subject matter officers will be dissociated from research direction. They will thus be able to concentrate their attention on extension leadership within their areas of responsibility.

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE

FUNCTIONS

The Biology Branch consists of plant pathologists, legume bacteriologists and dairy bacteriologists. Plant pathologists carry out research work on diseases of plants, diagnose plant diseases and advise on plant disease control and plant quarantine. Legume bacteriologists carry out research in relation to the successful establishment of nodule-producing bacteria in the soil and on the plant. The Australian Inoculant Research and Control Service operates a quality control service for commercial legume inoculants. Dairy bacteriologists carry out research on biological quality of locally produced and imported products.

The Chemistry Branch brings to the agricultural and related industries the benefits of research in, and knowledge of, chemistry and related sciences with particular reference to soils, waters, plant nutrition, cereals, pesticides and dairy chemistry.

The Entomology Branch develops new and improved means of insect pest control as an important factor in efficient and economic production by primary industry. In recent years increased emphasis has been given to the ecological approach to assist with the development of integrated pest control or "pest management" programmes. Avenues are currently being sought for use of new approaches in pest control such as anti-feedants and hormonal control of insect development. Results of research are incorporated into farming activities by liaison with the Department's extension services and direct contact with those responsible for agricultural production.

STAFF

Vacancies

The loss of experienced staff and deferment of action for their replacement in the cereal section of the Chemistry Branch caused serious delays in the high priority work of assessment of promising wheat crossbreds approaching the release stage.

One position of entomologist continues unfilled pending entry on duty of Dr A. Black, University of California (Riverside), who was specially recruited for research into the toxicology of insecticides to insects. An extended delay in the filling of one position of entomological assistant necessitated an internal secondment to ensure continuity of research in the high priority fruit disinfection investigations on light-brown apple moth.

Severances

Two plant pathologists and one bacteriologist resigned during the year and Mr R. Bament, Locust Patrol Officer, resigned after 8 years of service.

Overseas Visits

Dr N. G. Nair, Plant Pathologist, proceeded overseas in January, 1973, to the University of Aston in Birmingham, U.K., for a period of one year. Dr Nair has been awarded a Leverhulme Visiting

Commonwealth/American Fellowship to the University of Aston where he is studying the physical environment and the function of the mushroom bed casing material in relation to the production of mushroom fruiting bodies with particular reference to the mode of action of carbon dioxide in this process.

Miss P. Broadbent, Plant Pathologist, proceeded overseas in March, 1973 to undertake a 6 months study tour. Miss Broadbent is visiting centres of research on soilborne diseases and citrus diseases in the United States, Canada and Europe. She will attend the Second International Congress on Plant Pathology at the University of Minnesota in September.

Miss B. J. Ballantyne, Plant Pathologist, undertook a 4 months study tour from June to October, 1972. She visited centres of research on vegetable diseases and breeding for resistance in the United States and Europe. Miss Ballantyne attended the meeting of the Pacific Division of the American Phytopathological Society in Eugene, Oregon, the Annual Meeting of the American Phytopathological Society in Mexico City and the Annual Meeting of the American Society for Horticultural Science in St Paul, Minnesota. Papers were presented at Eugene and St Paul on the association of disease resistances in beans and on specific and non-specific resistance to rust in beans.

Committees and Conferences

Seventeen entomologists attended the 14th International Congress of Entomology in Canberra 22nd–30th August, 1972. Six entomologists read papers and the Chief Entomologist was convener of the Agricultural Entomology Section.

The Chief Chemist attended the Australian UNESCO Seminar on Drought at the University of N.S.W.

The Deputy Chief Chemist attended the Second Australian Symposium on Analytical Chemistry.

Some of the more significant representations on committees were:

- Commonwealth Pesticides Co-ordinating Committee.
- Commonwealth Pesticides Sub-Committee.
- Interdepartmental Committee on Pesticides.
- Technical Advisory Committee of State Pollution Control Commission.
- Public Service Metric Co-ordinating and Advisory Committee.
- State Wheat Improvement Committee.
- Interdepartmental Committee on Pesticide Residues and Economic Poisons.
- Commonwealth and States Horticultural Committee—Subcommittee.
- Standards Association of Australia—Subcommittees.
- Argentine Ant Eradication Committee.
- Fresh Fruit Disinfestation Committee.

Training of Overseas Personnel

Training continued within the Chemistry Branch of a Colombo Plan visitor from Thailand, Mrs Yonchit Aguru.

Dr Sen, FAO Fellow from the Agricultural Research Institute, New Delhi, was given a training course for a period of 4 months in legume bacteriology.

Miss H. van Haga, a student at the University of Wageningen, Holland, was assisted with studies on insecticide resistance in the sheep blowfly from 1st May to 29th June, 1973.

NEW DEVELOPMENTS

A new laboratory has been completed at Rydalmere to enable further expansion of research into ecological and biological control of soilborne plant pathogens. Work carried out so far has identified an important factor which controls microbiological activity in soil. This discovery could lead to practical application of the principle of biological control of soilborne pathogens which have, in the past, proved difficult to control except by the use of chemicals, some of which leave undesirable residues in the soil.

BIOMETRICAL BRANCH FUNCTIONS

The staff of the Biometrical Branch consult with and advise other research workers in the Department on the design of experiments and on their analysis and interpretation; and on sampling and survey methods and other statistical and mathematical problems. At the beginning of an investigation the

biometrician helps to clarify and define objectives, to select the precise questions to which answers are to be sought and to decide the exact plans and procedures to be followed. On completion of the experimental work he carries out the appropriate statistical analyses, advises on the interpretation of the results and may assist in the preparation of material for publication. The Branch is also responsible for scientific computing in the Department and the staff prepares programs to perform analyses by computer and advises on their use.

The Chief Biometrician is a member of the Mathematics Course Assessment Committee formed by the Advanced Education Board. During the year the committee considered proposals of the N.S.W. Institute of Technology for a degree course in mathematics and a graduate diploma in data processing.

NEW DEVELOPMENTS

Financial support by the Commonwealth Extension Services Grant allowed the Branch to carry out its computing through private firms. This greatly speeded up analysis and this will be further improved when the terminal incorporating a card-reader and high speed printer is operable. The terminal has actually been in the Branch for 4 months but the Postmaster-General's Department has been unable to supply a modem for it.

To improve the contact between research staff and biometrician, the biometricians in Sydney have been assigned to groups and groups have been assigned to carry out the work from several research stations. It is hoped that this will make it easier for research staff to determine which biometrician to approach for assistance.

DIVISION OF MARKETING AND ECONOMICS

FUNCTIONS

The Division of Marketing and Economics undertakes research into all aspects of the production, marketing and handling of agricultural products, including development of research and extension methodology in agricultural economics and farm business management; provides advice on commodity prospects, marketing schemes and rural policy generally, and working mainly through other Divisions provides extension services in agricultural economics and farm business management. The Division also provides specialized liaison and in-service training in agricultural economics and farm business management to departmental research and extension officers.

The Division publishes a journal, the *Review of Marketing and Agricultural Economics*; a monthly *Commodity Bulletin*; and a bulletin series which under the general title of *Miscellaneous Bulletin* reports a variety of research studies, survey results and data collections. A number of regional economists publish local bulletin series to provide farmers and others with farm management and agricultural economics data.

A complete price reporting service is provided for all produce markets in the Sydney metropolitan area and a retail price reporting service for meat, fruit and vegetables, and certain other commodities. The Division also provides crop forecasts, and market outlook and commodity information for a number of products. It also administers the Marketing of Primary Products Act, 1927, under which a number of primary produce marketing Boards are constituted, and provides a member on a number of those Boards. The Division also provides a representative on a number of other State and Commonwealth Boards and committees. Under the terms of the Dairy Industry Authority Act, the Division conducts cost-income surveys of all aspects of the dairy industry in New South Wales.

STAFF

New Appointments and Resignation of P. C. Druce

Mr P. C. Druce, Chief of the Division of Marketing and Economics, resigned his position on 6th October, 1972, to take up appointment as Chairman of the New South Wales Grain Elevators Board. Dr D. E. Maccallum was subsequently appointed Chief of the Division and Mr J. W. Elston, Deputy Chief.

From his appointment as an economist in June, 1943, to his resignation in October last year Mr P. C. Druce had a lengthy record of distinguished service with the Department. In 1951, he was appointed Principal Economics Research Officer and in August, 1965 became Deputy Chief of the Division. He was appointed Chief in 1970. He played a vital role in the Division's economics extension and research services and the building up of a professional staff establishment to handle these services. He was responsible for the initiation and development of farm management advisory services in N.S.W. which set a pattern for the development of similar services in the other States of Australia.

Mr Druce had undertaken chairmanship of a committee to advise the Government on the economic effects on primary industry of the revaluation of the dollar. He was a departmental representative on the trade mission to South East Asia, a member of the Rice Marketing Board, the Australian Tobacco Board, and the Dairy Industry Prices Tribunal. He was responsible for establishing the *Review of Marketing and Agricultural Economics* as a journal with international recognition. He was at one time president of both the State Branch and the Federal Council of the Australian Agricultural Economics Society and made a significant contribution to the development of agricultural economics in Australia.

He played an important part in the establishment of the Agristaff Credit Union and held the position of Chairman of the Board of the Credit Union. For many years he was the departmental representative on the Professional Officers Association Council.

Miss S. A. Hodgkinson was appointed to a new position of Special Economist (Marketing).

Mr G. A. Rance was appointed to the position of Principal Extension Economist subject to appeals.

With the appointment of Mr G. Mason to the new position of Special Economist (Farm Management), the previously existing position of Special Economist (Irrigation) lapsed.

Overseas Visits

Mr N. R. Baker, Special Economist (Commodities) was awarded a Winston Churchill Fellowship to study market prospects, institutional arrangements, policy and distribution of grains and oilseeds. Mr Baker visited North America, Europe, Russia and the Near East over a period of 16 weeks in late 1972.

Dr R. C. Duncan, Principal Research Economist, was awarded a CSIRO Post-Doctoral Fellowship to visit the United States to study developments in economics and agricultural economics research.

Committees

More prominent committees on which divisional officers serve are as follows:

The Chief, Division of Marketing and Economics, is the New South Wales Government Representative on the Australian Tobacco Board. The Deputy Chief is a deputy member on the Australian Tobacco Board. The Chief also acts as State Agent on the Tobacco Industry Leaf Finance Agency.

The Chief continued as a member of the Dairy Industry Prices Tribunal and as a Departmental representative on the State Development Co-ordinating Committee and on the Markets Joint Subcommittee of the Illawarra Regional Development Committee.

The Chief is also a member of the Inter-Departmental Standing Committee on Rural Adjustment and on the Guidelines Committee Assisting the Rural Assistance Board; in addition an economist of the Division acts as Secretary to these Committees.

On being appointed Chief of the Division Dr D. E. Maccallum continued as a Standing Committee on Agriculture representative on the Australian Committee for Coding Rural Accounts.

Dr Maccallum is also a ministerial nominee on the Oats Marketing Board for the State of New South Wales.

The Chief is also a member of the newly established committee to implement recommendations of the Brewer Meat Industry Report.

The Special Economist (Crop Forecasting) is a member of the Inter-Departmental Committee on Coarse Grains and chairman of the New South Wales Wheat Forecasting Committee. He is also a ministerial nominee on the Barley Marketing Board for the State of New South Wales.

The Special Economist (Commodities) in addition to being a member of the Grains Liaison Advisory Committee is a ministerial nominee on the Grain Sorghum Marketing Board for the State of New South Wales.

The Special Economist (Marketing) is a member of the New South Wales Meat Production Forecasting Committee and a ministerial nominee on the Oilseeds Marketing Board for the State of New South Wales.

Mr B. B. Coomber, Economist at Leeton, is a ministerial nominee on the Wine Grapes Marketing Board.

Staff Training

A significant feature of the Division's training is to encourage officers to participate in professional conferences and courses and to undertake post graduate studies.

During the year one officer was awarded a Master of Economics degree and one a Doctor of Philosophy degree.

As at 30th June, 1973, three officers were enrolled for a Masters degree on a full-time basis and two were undertaking formal study for a Doctor of Philosophy degree. A further eight officers were pursuing a Masters degree on a part-time basis. Two other officers were on full-time study leave and were undertaking the Diploma in Rural Accounting at the University of New England.

Seven other economists were undertaking postgraduate studies on a part-time basis in the areas of business management and administration, law, political economy, real estate valuation and accountancy.

The Division had thirteen university trainees working towards Bachelor degrees in agricultural economics and agricultural science.

A number of officers of the Division represented the Department at the following professional conferences: The National Agricultural Outlook Conference; the Annual Conference of the Australian Agricultural Economics Society; the Second Annual Congress of Farm Business Management, 1973; the Australian Agricultural Extension Conference 1973; and the CSIRO Australian Specialist Conference on Crops of Potential Economic Importance.

International Training Course

The special economist (marketing) acted as New South Wales co-ordinator for the International Seminar and Study Tour on Marketing of Agricultural Products.

NEW DEVELOPMENTS

Revision of the Marketing of Primary Products Act, 1927, begun in 1971-2, was continued during the year. Complete review of this Act is going to be a lengthy process.

The three-man Commodity Unit consisting of two Economists and a Special Economist (Commodities) was fully staffed during the year.

A Market Services Unit consisting of two economists and a special economist (marketing) was also established to undertake the investigation and implementation of market intelligence services; to provide advice to primary producers, marketing boards and others on marketing procedures and practices and to advise on policy matters relating to marketing.

A Special Economist (Farm Management) was appointed to allow research to evaluate farm management extension and to enable greater co-ordination of the many extension publications produced by the Division's officers.

DIVISION OF RESEARCH SERVICES

FUNCTIONS

The Division of Research Services is comprised of four sections:

- Research Administration.
- Research Station Management.
- Architecture.
- Agricultural Engineering.

The research administration section comprises the Research Co-ordinator and his research administration functions, the Regional Directors of Research and their respective staffs at Wagga Agricultural Research Institute, Tamworth Agricultural Research Centre, Wollongbar Agricultural Research Centre and Yanco Agricultural College and Research Centre.

The research station management section is responsible for the control and administration of the Wagga Agricultural Research Institute and the Department's research stations and centres with the exception of the Veterinary Research Station, Glenfield and the Cattle Tick Research Station, Wollongbar. The Division is also responsible for the overall supervision of farming activities on the Veterinary Research Station, Glenfield and at the Hawkesbury, Wagga, Orange and Tocal Agricultural Colleges.

The architect's section is responsible for the organization and implementation of the Department's capital works programme. It also designs and supervises all maintenance work on research stations and assists college principals in connection with maintenance programmes. It provides a liaison with officers of the Department of Public Works and the Housing Commission and, in addition, supplies plans and advisory information to other authorities and to members of the public.

The agricultural engineering section is responsible for the agricultural engineering extension activities of the Department through its seven agricultural machinery officers located in the various agricultural regions throughout the State. Research work is carried out at the newly established agricultural engineering centre at Glenfield, where prototype machines are made for the agricultural industries and for departmental research officers. This section is also responsible for the purchase and maintenance of all departmental plant, equipment and machinery.

Retirements and Appointments

Dr F. Von Mengersen, Senior Research Officer, retired on 20th March, 1973, after 20 years outstanding service as an oat breeder with the Department. Dr Mengersen was responsible for the selection of the oat variety Cooba which is now the most popular variety grown in New South Wales. It is the highest producer of green fodder when sown early, has excellent grain recovery after heavy grazing, is early maturing and has the lowest husk to grain percentage of any Australian commercial oat varieties. Bushel for bushel the Cooba oat variety provides more value than any other variety. Dr Mengersen was also responsible for the selection and breeding of the oat variety Coolabah which is the second most popular variety in New South Wales.

Mr V. Austen, Field Assistant, Narara Horticultural Research Station, retired after many years of faithful service.

Mr E. J. Craze, retired from the position of Plant Inspector after 21 years of service with the Department. He was initially appointed as a motor mechanic at Yanco Experiment Farm and in 1955 was promoted to Plant Inspector at head office.

Regional Directors of Research have been appointed as follows: Dr S. G. Grimmett, Wollongbar; Dr W. V. Single, Tamworth; Dr A. T. Pugsley, Wagga; and Dr D. J. McDonald, Yanco.

Dr A. J. Williams was appointed Supervisor of Research at Trangie Agricultural Research Station and Mr P. Mears, Supervisor of Research at the Grafton Agricultural Research Station.

Mr Wingate-Hill, a highly qualified engineer from England was appointed Agricultural Engineer for research work at the Glenfield Agricultural Engineering Centre.

Committees

Some of the more significant committees on which officers of the Division represent the Department are:

- Advisory Committee on Research in Agriculture.
- Advisory Committee of the Agricultural Research Institute, Wagga.
- Auscott Postgraduate Scholarships Committee.
- I.R.E.C. Executive Research Panel.
- Bush Fire Council of N.S.W.
- Rural Safety Promotions Committee.
- Tobacco Advisory Committee.
- Wine Grapes Marketing Board.

Assistance to Overseas Personnel

The agricultural engineering centre arranged a tour of controlled atmosphere storage facilities and provided information on the design of controlled atmosphere generator and plastic storage tents to Japanese manufacturers and a professor from the University of Tokyo. They also provided information on soil pots to a representative from Bougainville Copper Mines.

The newly-appointed Chief Engineer (Agricultural Production) of FAO, was briefed by the senior agricultural engineer concerning the position of agricultural engineering in Australia and other agricultural engineering staff at head office gave assistance to representatives from England, Algeria, Hungary, Israel, Philippines, Spain, India, Japan and Papua New Guinea on various agricultural engineering and farm mechanization matters.

Agricultural machinery officers assisted in an International Training Course in Agricultural Extension for Fellows from sixteen countries; an International Training Course in Irrigation for students from ten Asian countries and a training programme for a Nigerian delegation tour to study irrigation and cattle mechanization practices.

Glen Innes Agricultural Research Station provided practical training for Indian veterinarians visiting Australia.

Contingents from Brazil and Uruguay sponsored by the World Bank were shown irrigation research techniques, pasture utilization and reproductive surgical techniques at Leeton Agricultural Research Station.

Activities at Narrabri Agricultural Research Station included a visit, supported under the special Commonwealth African Assistance Plan, by five high-ranking Nigerians, interested in dry farming and water resource management and the arrangement of a tour for seven Colombo Plan students and four cotton scientists from Russia.

The Poultry Research Station, Seven Hills, Trangie Agricultural Research Station and Wollongbar Agricultural Research Centre were other institutions to provide assistance and training to overseas personnel.

NEW DEVELOPMENTS

In furtherance of the Department's programme of regionalization of research four Regional Research Directorates were established with Centres at Wollongbar, Tamworth, Wagga and Yanco. Details of appointments of Regional Directors of Research appear in the section dealing with staff appointments.

PRODUCTION AND LIVESTOCK

Production during the year at research stations administered by the Division was: winter cereals 16,284 bushels; grain sorghum 35,138 bushels; maize 900 bushels; hay 1,883 tons; silage 54 tons; cotton 14,040 lb; tobacco leaf 850 lb; potatoes 180 bags; sweet potatoes 119 cartons; wool 66,405 lb; apples 9,810 bushels; eggs 75,379 doz.; pears 292 bushels; peaches 393 bushels; nectarines 18 bushels; plums 2 bushels; gordos 3,326 lb; sultanas 7,031 lb; pecan nuts 200 lb; bananas 8,225 bunches; avocados 508 cartons; citrus 28,032 bushels; nursery trees 25,398 trees; nursery fruit for seed 27 bushels; horticulture buds 65,194 buds; pawpaw 1,770 lb.

Stock numbers as at 30th June, 1973, at research stations administered by the Division were: cattle 2,995 head; horses 24 head; sheep 16,108 head; pigs 399 head; poultry 8,410 birds.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

FUNCTIONS

The Royal Botanic Gardens and the National Herbarium of New South Wales provide a broad coverage of advisory information and research services in botany and ornamental horticulture. The Herbarium contains some 750,000 specimens, representing in particular the native and naturalized flora of Australia but also including a considerable collection of the world flora.

Its research activities are directed in particular to the production of a detailed and comprehensive *Flora of New South Wales* but studies are extended where appropriate to wider problems in systematic botany including investigations of breeding systems and chromosomal studies. In the ecological field, a vegetation survey of New South Wales is the major activity.

The Gardens display a wide variety of plants from throughout the world and are currently undergoing gradual redevelopment to fulfil an enlarged educational function in general botany and biology as well as in the horticultural and landscaping spheres. Associated with the Gardens are the Mt Tomah Annexe for cool-temperate plants, as well as the Domains and Centennial Park, the functions of which are those of large parks, catering for passive recreation, sporting activities, and wildlife conservation.

STAFF

Development and maintenance of the Royal Botanic Gardens continues to be hampered by the difficulties still being experienced in maintaining full staff strength, especially skilled artisans.

Effective ranger control throughout all areas has also been deficient. As at 30th June, 1973, three of the six posts were vacant with a further resignation pending.

Staff turnover in general continues at a high level with losses during the year totalling 112 personnel including 98 resignations.

Appointments and Severances

Dr Barbara G. Briggs was appointed Deputy Chief Botanist in October, 1972, transferring from the research scientist classification.

Dr Wee-Lek Chew, Botanist, was appointed as Senior Research Scientist in February, 1973.

Mr H. M. Wilson, Foreman, Admiralty House, since 1966 retired on 23rd March, 1973, after 29 years of service. Mr F. Appleton, formerly Gardener Special Class, was promoted to fill the vacancy. Mr J. Piotrowski, formerly Agrostologist Assistant, was promoted to Foreman, Outer Domain.

Committees and Conferences

The Director, Superintendent and Senior Landscape Designer attended the 45th National Conference of the Australian Institute of Parks and Recreation held at Broadbeach, Queensland from 1st-6th October, 1972. The Superintendent also attended the Environment 1973 Conference in Sydney. The Centennial Park Superintendent attended the Australian Institute of Parks and Recreation Service, School of Parks Management conducted in Canberra in conjunction with the Canberra College of Advanced Education.

The Director is convener of a committee set up by the Premier to enquire into the causes of deterioration of Norfolk Island pines on metropolitan beaches. Mr W. Watson (Superintendent) and Mr J. Pickard (Ecologist) are also members of this Committee.

A research fund has been set up to assist in the botanical research of the National Herbarium. Contributions to this fund are allowable tax deductions and there have been a considerable number of modest contributions from individuals who have benefited from the work of the Herbarium. It is hoped that some support will be forthcoming from commercial organizations in the future.

In October, 1972, the Superintendent, Royal Botanic Gardens, Mr W. R. Watson, was elected to the position of National President of the Australian Institute of Parks and Recreation. He was also appointed to the Harbour Carnival Committee of the Sydney Opera House Official Opening Committee and made Chairman of the Associated Accommodation Sub-Committee. He continues to serve on the Horticulture Advisory Committee of the Department of Technical Education.

Assistance to Overseas Personnel

Messrs Chan, Wong and Lee, the fourth, fifth and sixth Hong Kong Fellows to be placed at the Royal Botanic Gardens, commenced their 2 year period of intensive horticultural training in April, 1973.

Mr I. Ramelan, a Colombo Plan Fellow from the Department of Agriculture, Indonesia, spent 18th-29th September, 1972 at the Royal Botanic Gardens as part of his Australian study tour of horticultural techniques, planning and organization.

Many notable visitors from overseas were assisted in their investigations by consultations with botanical and horticultural staff and/or by the granting of study facilities.

NEW DEVELOPMENTS

Mrs B. Jacobs was seconded from the Department of Education as education officer to survey the needs and resources for an educational programme at the Gardens. Her study has shown a high level of interest in such a programme and educational tours for school parties and the provision of informative material have proved most successful.

Recent legislation calling for environmental impact statements and enquiries on environmental significant new developments is placing heavy demands on the services of the two ecologists of the Herbarium staff. Many developments have potential effects on vegetation and the opportunity for these effects to be assessed is welcomed. Community awareness of environmental matters has led to increased demands for plant identification services as well as to a request for investigation of the growth of marine algae in areas likely to be affected by increased pollution in the near future.

In consequence of the introduction of summer time an overall examination was made of hours during which public meetings may be held in the Domain without special approval of the Minister for Agriculture, and these hours have now been varied and regulations amended to provide for an extension of hours from 2 p.m. to 6.30 p.m., November to February inclusive (previously 2–5.30 p.m.). No change was made to hours specified for other months of the year.

SPECIMEN STORAGE AND WORKING SPACE PROBLEMS

Over recent years the severe overcrowding of both specimen storage areas and working space at the National Herbarium has seriously hampered efficient work and prevented the specimen collections being given curation and storage conditions necessary to their adequate maintenance. The situation is now extremely acute in that all available space in the Herbarium building will be occupied within a very few years, and further re-organization within existing space cannot be expected to alleviate the situation. Apart from the need to provide adequate working conditions, it is essential that erection of a new building commence very soon, in order that it is available for use by the time the present building completely reaches the limit of its capacity. The specimen collections represent a considerable national asset and it is most unsatisfactory that some sections are very difficult of access or effectively unavailable for use because of the overcrowded conditions prevailing.

LIBRARY

New material totalled 2,559 items (150 books, 1,115 issues of periodicals, 831 pamphlets and reprints and 5,000 trade publications); 524 items were catalogued and 800 periodical articles were indexed. Loans to members of staff totalled 1,598; interlibrary loans totalled 338.

LIVESTOCK

Two departmentally bred Arab geldings remain in service as rangers' mounts at Centennial Park, but a third is still required to replace a donated thoroughbred gelding "Kings Fort" which has been retired to Hawkesbury Agricultural College.

AGRICULTURAL EDUCATION SECRETARIAT

FUNCTIONS

The Agricultural Education Secretariat was established in 1970 to co-ordinate the functions, operations, and the administration of the Hawkesbury, Wagga, Orange, Yanco and C. B. Alexander Agricultural Colleges.

The secretariat is charged with:

- Integration of agricultural education with other functions of the Department.
- Formulation of policy and plans for new and improved developments in agricultural education.
- Processing decisions and recommendations from the Committee of Advice on Rural Studies and from the Advanced Education Board.

Control is exercised over expenditure of funds provided by State and Commonwealth for capital works projects for the construction of new buildings and educational facilities at agricultural colleges. The allocation and review of expenditure of moneys provided for maintenance and operating expenses provided from Consolidated Revenue is undertaken also.

Purchase of books and periodicals throughout the Department are co-ordinated by the Secretariat. It also processes applications for college enrolments.

STAFF

Vacancies

A number of positions remained vacant for the major part of the year. Appointments were made to several senior lecturing positions. Staff were recruited to fill positions at Orange Agricultural College in order to prepare for the first intake of students in July, 1973.

Appointments

Dr P. M. Martin, Deputy Principal, Hawkesbury Agricultural College.
 Mr M. N. Rayner, Senior Lecturer, Hawkesbury Agricultural College.
 Mr B. M. Kelleher, Master of College Halls, Hawkesbury Agricultural College.
 Mr A. L. Passmore, Lecturer, Hawkesbury Agricultural College.
 Mr F. P. Dunlop, Lecturer, Hawkesbury Agricultural College.
 Mr J. W. Packard, Manager, Field Operations.
 Dr D. Heaton-Harris, Senior Lecturer, Wagga Agricultural College.
 Dr E. R. Hunt, Senior Lecturer, Orange Agricultural College.
 Mr J. Davis, Senior Lecturer, Orange Agricultural College.
 Mr R. J. Napier, Lecturer, Orange Agricultural College.
 Mr W. J. Esler, Lecturer, Yanco Agricultural College.
 Mr C. F. Weekes, Supervisor of Applied Studies, Hawkesbury Agricultural College.
 Mr P. N. Carroll, Supervisor of Applied Studies, Hawkesbury Agricultural College.
 Mr C. D. Kohlhoff, Research Officer, Hawkesbury Agricultural College.
 Mr G. E. Vaughan, Supervisor of Applied Studies, Hawkesbury Agricultural College.
 Mr E. S. Henry, Supervisor of Applied Studies, Orange Agricultural College.
 Mr B. K. Smart, Supervisor of Applied Studies, Orange Agricultural College.
 Mrs H. C. Nolan, Librarian, Orange Agricultural College.
 Mr R. R. Emes, Secretary, Orange Agricultural College.
 Mr M. J. Boland, Secretary, Wagga Agricultural College.
 Mr L. R. Lucas-Smith, Administrative Officer, Hawkesbury Agricultural College.

Retirements and Resignations

Dr F. C. McMullen, Senior Lecturer, Hawkesbury Agricultural College.

Mr D. A. Caffin, Lecturer, Hawkesbury Agricultural College.

Overseas Visits

Mr B. D. Swann, Lecturer, Yanco Agricultural College, visited the United States of America.

Mr W. A. Barr, Lecturer, Hawkesbury Agricultural College, visited New Zealand.

Mr J. G. Bird, Senior Lecturer, Hawkesbury Agricultural College, visited the United States of America and the United Kingdom

LIBRARY ACTIVITIES

The secretariat processed requests for the purchase of reference books, periodicals, etc. Items ordered amounted to almost \$50,000, the majority of which related to continuing subscriptions to journals and other periodicals. A detailed report of the central library activities is given earlier in this section under the heading of "State Office Block Library".

3.1 RESEARCH ADMINISTRATION

RESEARCH STAFF

The Department has a research staff of 399, including research administrators, who are located in central offices, central laboratories, Regional Research Centres and Research Stations. Others are located with Universities and with a number of CSIRO laboratories.

The four Regional Research Centres predicted in last year's annual report have now been established and Regional Directors of Research appointed. The Directorates are located at:

Agricultural Research Institute, Wagga Wagga, which has a research staff of twenty-six, with twenty-four additional staff located at associated stations.

Agricultural Research Centre, Tamworth, which has a research staff of twenty-two, with twelve additional staff located at associated stations.

Agricultural Research Centre, Wollongbar, which has a research staff of twenty, with sixteen additional staff located at associated stations.

Agricultural College and Research Centre, Yanco, which has a research staff of sixteen, with thirteen additional staff located at associated stations.

A Director of Research is to be appointed to Trangie Agricultural Research Station. A Supervisor of Research has been appointed to Grafton Agricultural Research Station, and a similar appointment is to be made at Glen Innes.

TRAINING OF SCIENTIFIC STAFF

The number of officers undertaking postgraduate study of various kinds is being maintained at a constant level. Masters degrees were awarded to eight officers, while a further sixty-seven are continuing with studies aimed at obtaining a Masters degree, mostly on a part time basis. Doctorates were awarded to four officers, while a further thirty-five continued their studies towards this degree. Of this number, twenty-seven are studying at Australian universities, while the remainder are located at overseas research institutions. A further six officers undertook post-graduate diplomas and three were awarded post-doctoral scholarships.

Attendance of delegations of departmental officers was organized at a wide range of technical conferences, including many at an Australia-wide level and some at the international level. Two officers participated by invitation in the Second General Congress, Society for the Advancement of Breeding Researches in Asia and Oceania, held in India in February, 1973. A third officer was invited to present a leading paper at the Asian Pacific Weeds Conference, held in New Zealand in March, 1973. An event of some note was the holding of the 14th International Congress of Entomology in Canberra, which was attended by seventeen officers of this Department.

Where necessary, officers received training in specialized techniques used in their research programme. One officer from the Cereal Chemistry Section received training in histological and staining techniques, three entomologists were trained in bioassay and insecticide resistance techniques, while two officers from the Division of Dairying attended radioisotope courses conducted by the Atomic Energy Commission at Lucas Heights.

NEW DEVELOPMENTS

The Entomology Branch continued and expanded the development of the integrated pest control concept as a basis for its approach to insect problems. There was also an expansion of bioassay investigations for the laboratory screening of insecticides and monitoring for insecticide resistance as a result of the diagnosis of resistance to DDT and endrin in cotton bollworm and dichlorvos resistance in lesser grain borer. Resistance monitoring was also initiated in two-spotted mite.

Attention to research on new crops was further intensified. A rapeseed breeder was appointed at the Wagga Agricultural Research Institute and, in response to a recommendation from the Minister's Advisory Committee on Research in Agriculture, an interdisciplinary research team has been created to concentrate on the problems of rapeseed production in the initial stage.

In the Division of Marketing and Economics there has been a marked increase in the amount and type of research being conducted into agricultural policy questions. Particular examples are wheat stabilisation, urban intrusion, pest control policies, meat prices and population trends. Substantial research has commenced on supply analysis, particularly with meat and grains. Factors affecting the demand and supply of agricultural labour and labour mobility, and the implications of a 35-hour week for agriculture have also been examined.

RESEARCH COMMITTEES

As detailed in section 2 (Administration) of this report, substantial funds for the conduct of research are granted by various industry research funds and other organizations such as the Reserve Bank. The research conducted with the assistance of outside funds is reviewed annually by departmental committees composed of senior research personnel of the divisions, institutes and stations concerned. In addition each major project is examined individually throughout the year.

During the year a Cotton Research Co-ordination Committee was formed, composed of officers from CSIRO and this Department. The formation of this Committee followed the decision of the executive of CSIRO to locate the cotton research conducted by that organization at the Narrabri Agricultural Research Station.

VISITORS

Various sections of the Department received many visits from both interstate and overseas scientists. Because of the holding of the 14th International Congress of Entomology in Australia, the Entomology Branch was visited by many leading overseas authorities who were in Australia to attend the Congress. These included Professor R. L. Metcalf, University of Illinois, U.S.A., Professor J. R. Busvine, London School of Hygiene and Tropical Medicine, and Dr J. Keiding, Danish Pest Infestation Laboratory, Denmark. Dr K. F. Baker, Professor of Plant Pathology at the University of California, again spent a period of 6 months in the Biology Branch working with the soil microbiology group on the biological and ecological control of soilborne diseases. Dr G. E. Stembridge, Associate Professor of Horticulture, Clemson University, South Carolina, U.S.A., spent some time with officers of the Division of Horticulture in discussions concerning the use of growth regulators with stone and pome fruit.

3.2 RESEARCH ACTIVITIES

HORTICULTURE AND HORTICULTURAL PRODUCTS

STONE FRUITS

(See also section dealing with irrigation and drainage)

Variety Introductions, Selection and Testing

The testing of a group of introduced varieties, planted into trial blocks at Yanco Agricultural College and Research Centre and Bathurst Agricultural Research Station in the early 1960's, has been completed with selections now being used in commercial plantings. Evaluation of a group of Babygold selections and four South African canning peaches at Yanco, together with the Nectared series of nectarines at Bathurst and in district trial plots, is continuing.

A further series of introductions was made during the year, including recently released canning peaches from California, some varieties of dessert peaches that appear to have potential for early fruit production and strains of the Montmorency sour cherry.

Rootstock Evaluation

Growth differences have so far been insignificant in recently established trials in which three commonly used peach seedling rootstocks, Pullars, Golden Queen and Elberta, are being compared with Nemaguard and Okinawa seedlings, two varieties used overseas.

In a rootstock evaluation trial for apricots at Yanco A.C.R.C., trees on Buck plum have continued to make more vigorous growth than those on apricot seedling.

Nutrition

A 3-year survey of leaf nutrient levels in well managed orchards revealed low nitrogen levels in many peach, apricot, sweet cherry and prune blocks. High potassium levels caused nitrogen/potassium imbalances in some peach and many apricot plantings in the M.I.A. and may have contributed to poor fruit quality. The industry is being encouraged to use the Department's leaf analysis service.

Further evidence was obtained that the surface waxes, especially those on the lower cuticle of the leaf, are the main barriers to foliar-applied chemicals on peach trees. Evaluation of suitable adjuvants to improve foliar absorption under field conditions is continuing.

Weed Control

Herbicide trials were continued in young peaches and prunes at Bathurst A.R.S. Mixtures of terbacil and diuron again gave excellent season-long control of weeds at application rates as low as 0.45 kg of each material. Applications at this rate produced temporary phytotoxic symptoms in prunes, but no symptoms were observed in peaches with applications of 0.91 kg of terbacil and 0.45 kg diuron. With both prunes and peaches, tree growth was greatest where complete weed control was maintained under the herbicide treatments.

Crop Regulation

Thinning trials with canning peaches were extended to investigate the possibilities of mechanical thinning with a tree shaker. In comparisons made between thinning at various stages of fruit development, it was shown that trees thinned before pit hardening produced the lowest total yield but the highest percentage of canning quality fruit.

Mechanical Harvesting

Problems associated with the mechanical harvesting of fruit continued to receive attention. Initial trials were conducted to compare two catching surfaces (deceleration frames) for the amount of injury to fruit removed from trees with a mechanical shaker.

Further investigations aimed at spreading the harvest period and effecting evenness of fruit maturity within blocks with growth regulators were conducted on peaches, apricots and prunes. Further trials will be needed with application times and rates with all materials (dimazide, ethephon, gibberellic acid) before recommendations can be released.

Intensified Planting and Tree Training

In pilot trials at Bathurst A.R.S. and Yanco A.C.R.C., the practicability of training peach trees to a hedge row form for more convenient harvesting operations has been demonstrated. A larger area has now been established at Yanco on which economic studies will be conducted on relative costs of management of various training systems.

Post Harvest Problems

Some problems associated with the practical application of previous results with fungicidal dipping were investigated and some new materials were screened for control of both brown and transit rots. The improvement in the effectiveness of benomyl with the length of standing between preparation and usage, demonstrated last year, was confirmed, but negative results were obtained with other chemicals, e.g. thiophanate methyl, which were expected to react in the same way. Poor results were obtained with all treatments for transit rot control.

Pest and Disease Control

Integrated pest control: Investigations into integrated control of oriental fruit moth (*Cydia molesta*) in the M.I.A. continued. Oriental fruit moth is an important pest of peaches, but is variable in incidence. Current recommendations of wide spectrum insecticides such as azinphos-methyl and carbaryl are effective against this pest, but often result in increased mite populations. Spray programmes reduced to applications against the spring brood and supplemented by forecasts of potential fruit damage, based on tip damage in January, appear satisfactory, but evaluations will be continued for several more seasons. Testing of various types of traps to obtain information on the flight patterns of oriental fruit moth was undertaken in the Bathurst district although moth activity was low this season.

Diseases: Epidemiological studies of brown rot of stone fruits, caused by *Sclerotinia fructicola*, led to the introduction in 1971 of the brown rot forecasting service for the M.I.A., which is the first in the world for this disease. Benomyl has now been in commercial use for 3 years and is giving disease control superior to that obtained previously with other chemicals, but continued evaluation of new chemicals has indicated several that may be superior to benomyl.

Studies are continuing of the chemical regulation of bud shedding in peaches and two plantings of trees have been made at Yanco A.C.R.C. to determine whether bud shedding is of viral or genetic origin. The rate at which virus-free trees become infected and the impact of spreading viruses on tree yields have important implications for the virus-tested budwood scheme about to be implemented in N.S.W.

Bacterial canker, caused by *Pseudomonas syringae*, is a serious limiting factor for cherry growing in the Orange, Bathurst and Young districts. Continuing investigations in the Orange district during 1972 showed that the surface microflora of cherry tree leaves include highly pathogenic races of the causal organism, capable of infecting stems during autumn. It is proposed to initiate investigations at Orange to evaluate extensive spraying of nursery stock with the aim of producing canker-free trees for planting in district situations, as these methods of disease control have shown promise in New Zealand.

POME FRUITS

(See also section dealing with irrigation and drainage)

Cultural Practices

Planting density: Smaller trees and high density planting to induce earlier bearing and higher productivity in apples has developed the need to relate planting density to variety and rootstock combinations.

An apple tree spacing trial on Jonathan, Delicious and Granny Smith varieties on 4 rootstocks at Orange Agricultural Research Station is now 6 years old, with densities ranging from 430 to 827 trees per hectare. The first apparent signs of the effects of the closest planting have shown up this season. The closest planted trees at 2 to 2.3 m often had a reduction in crop compared to wider spaced trees, particularly trees on the more vigorous rootstocks MM106 and Northern Spy. The crop on a per hectare basis was usually similar, whether close spaced or wider spaced, unlike the previous season when closer planting per hectare produced double that of the wider planting.

Costs of establishment, maintenance and harvesting are being closely monitored in relation to gross returns. At this stage the rate of pruning is related to variety and rootstock and the rate of picking related to the amount of fruit picked rather than planting distance.

Tree training: Palmette and central leader systems in the trial to evaluate 4 tree training systems on apples at Orange A.R.S. had heavier cropping in the first season than standard vase or Hawkes Bay on 4-year-old trees, especially on Jonathan. Jonathans, even on seedling stocks, trained to the first two systems carried a moderate crop. The cost of establishment of the palmette system is 2½ times more expensive than the other systems. By the third year the Hawkes Bay, central leader and palmette systems are respectively 7.5 per cent, 18 per cent and 30 per cent more expensive in yearly costs than the conventional vase system.

Rootstock recommendations: In the earliest years, MM106 consistently showed its early cropping ability and carried the heaviest crop. It is a good performer under a wide range of conditions. Merton 793 has been very promising especially with the variety Jonathan. The rootstock GB35/28 has produced the biggest tree with very few apples until the eleventh year when it carried the most Delicious and Granny Smith.

In 1972 four varieties of pears, Packham's Triumph, Williams' Beurré Bosc and Josephine were planted at Orange A.R.S. on 2 quince rootstocks with an intermediate stem piece of Beurré Hardy to overcome any incompatibility. The aim is to produce a smaller tree with earlier cropping ability.

Mechanical harvesting: The effectiveness of two types of deceleration beds using shake/catch harvesting equipment under field harvest conditions was evaluated. Both deceleration beds in these preliminary results approximately halved the level of injury incurred from catching on hessian sheets on the ground, whilst at the same time, the degree of bruising from these deceleration beds was approximately double that of careful hand harvesting.

Nutrition: The development of commercial preparations of foliar nutrient sprays has led to a trial with several foliar spray treatments at Orange A.R.S. All foliar spray treatments produced more large fruit than untreated trees. Other effects in this first season were small, if any.

Herbicides: The four herbicides, simazine, diuron, amitrole and 2,2-DPA were incorporated in a trial on apples at Bathurst A.R.S. to establish any long term phytotoxic effects of excessive rates far greater than recommended. After 6 years of application, diuron at the heavier rates caused severe injury but recommended rates of all herbicides caused no damage. Two years after the last application diuron damage still occurs and weed control at these rates remains excellent. Simazine has nearly disappeared after two seasons.

Previously the susceptibility of Josephine pears at Bathurst to terbacil was demonstrated. Similar application rates over two seasons on Packham's Triumph have not shown any damage.

Investigation with Growth Regulatory Substances

Maturity regulation: The object of prolonging the effective harvesting period of Delicious apples was achieved at Bathurst, by hastening the maturity with ethephon and delaying maturity of other trees with Alar. Red colour was increased and quality in cold storage was not impaired. Better use of Alar without fruit shape alteration and other bad effects are being examined. Both growth regulants are also effective on maturity of Gravenstein apples in the Bilpin district and red colour was increased. Fruit size is a problem if maturity is hastened by 2 or 3 weeks with this early maturing variety.

Treatment with the growth regulators, GA and NAA are being investigated on the M.I.A. to increase fruit size and delay maturity of Williams' pears to suit cannery processing schedules.

Crop thinning: The good results from NAD and NAA on Williams' pears at Bathurst A.R.S. the previous season were repeated at Yanco A.C.R.C. NAA caused a slight reduction in total yield but the yield suitable for canning was higher than from untreated trees. NAD did reduce set at Orange A.R.S. on Packham's Triumph but there were no more large or medium sized fruit, only the number of small fruit being reduced. Some more promising results were obtained on Winter Cole pears at Batlow.

Effective thinning of Gravenstein apples was repeated with post-bloom sprays of NAA, but drought conditions at Bilpin reduced any effect on fruit size. Thinning results on Granny Smith, Jonathan and Delicious at Bathurst were variable and inconsistent, aggravated by hail damage and drought stress.

Fruit setting: One or two autumn post-harvest sprays or a full bloom spray of 2,4,5-TP often increased fruit set on Packham's Triumph pear at Bathurst A.R.S., but more small fruit was produced than on controls. Alar at 4,000 ppm increased the set without reducing size. There were no effects of altered fruit shape this season.

Propagation

Promising results have been obtained from propagating certain apple clonal rootstocks by means of hardwood cuttings. A further refinement of a clear plastic tent over the heated bed has led to better rooting and callusing this season. A commercial adaptation of this technique could be carried out, except in the propagation of Northern Spy.

Fruit Storage

Low temperature breakdown: Studies over a number of years have revealed that low temperature breakdown of apples can be reduced by increasing weight loss from the fruit. However there is some reluctance on the part of orchardists to encourage weight loss as this may adversely affect saleability.

In recent years studies on chemical control of low temperature breakdown of cool stored apples have been undertaken by injecting compounds directly into the core cavity. Early studies showed that acetate was important and injections of acetic acid increased the severity of the disease. Several growth regulators produced from the isoprenoid pathway were studied. These except for gibberellic acid (GA) either had no effect or increased the disease. GA reduced breakdown and work has been concentrated on finding ways of applying GA and determining the optimum concentration required.

Pest and Disease Control

Integrated control and pest management: Examination of the effectiveness of reduced strength insecticide for codling moth was continued at Bathurst A.R.S. The related effect of this on populations of two-spotted mite, light brown apple moth and beneficial insects was also investigated. Codling moth damage was higher under the low dosage treatment.

Field pest investigations: After continued use over several seasons, the efficiency of a miticide in controlling two-spotted mite decreases. This season, two miticides were identified as being significantly more effective than those currently in use. These miticides also exhibited residual activity.

The mixture of the chemicals binapacryl and captan, currently recommended for the control of two-spotted mite and apple scab, was thought to be phytotoxic to apples in blossom and so to affect fruit set. This was found to be incorrect at Bathurst A.R.S. and the mixture can be used with safety by apple-growers during blossoming.

Disinfestation treatments for light brown apple moth: During 1972, the Canadian Department of Agriculture accepted methyl bromide fumigation at 15°C or 20°C followed by cold storage at 0°C for 21 days as a disinfestation treatment for Australian deciduous fruit against light brown apple moth. This recognition resulted from investigations undertaken at the Gosford Citrus Wastage Laboratory and in other states. Subsequent studies confirmed that fumigation at 7°C was also effective. This will permit treatment of fruit precooled prior to export, provided the data is acceptable to Canadian quarantine authorities.

Codling moth: Following numerous unsuccessful attempts to culture codling moth on artificial media, a technique using apple thinnings has been successfully established at Bathurst A.R.S. The susceptibility of codling moth to currently used chemicals is being established for future determination of resistance and for screening new chemicals.

Two-spotted mite: Eleven chemicals were screened in the laboratory against two-spotted mite (Bathurst strain) and six were promising enough to warrant field screening. Work is progressing in the detection and measurement of resistance of two-spotted mite to commercially used miticides.

Disease control: The setting up of an apple and pear scab forecasting service in the M.I.A. was effective in assisting control measures in that area.

Several new fungicides are being evaluated on the control of powdery mildew of apples at Bathurst A.R.S. Compared to benomyl, binapacryl gave similar results whereas methyl thiophanate was superior.

Following grower complaints of inefficiency and fruit damage of a departmentally recommended hypochlorite based dip for the removal of Sooty Blotch stains from apples, dip parameters were investigated at the B.C.R.I., Rydalmere under laboratory and commercial conditions. pH and available chlorine content of the dip were found to be important factors for avoiding fruit damage while achieving acceptably short dipping times.

Virus free repository: Production of virus free clones of pome fruits is underway to be included in the N.S.W. budwood scheme mother tree blocks. Varieties and rootstocks are being heat-treated and tested for freedom from viruses.

Economics

Market outlook: While the market outlook for apples and pears is unfavourable in the short term the longer-term prospects are somewhat better. For the immediate future continued viability of the enlarged E.E.C. demand is in doubt. In the longer term domestic consumption is expanding, existing and new non-European outlets are growing and overall world production appears to be stabilizing.

Controlled atmosphere storage: A benefit cost study of controlled atmosphere storage of apples in the Orange district indicated that several types of storage systems were profitable. Rigid room controlled atmosphere storage was more profitable than normal air storage. Recirculating generator systems gave greater profits than flushing generator systems.

CITRUS FRUITS

(See also section dealing with irrigation and drainage)

Citrus Improvement

Citrus breeding: Over the period 1959-65, a hybridization programme was undertaken using *Poncirus trifoliata* as pollen parent with Cleopatra and Scarlet mandarin, Smooth Seville, Eureka, Myer and rough lemon, Ellendale tangor, Rangpur lime and Wheeny grapefruit for the development of new citrus rootstocks. Those already assessed for uniformity and rootstock suitability have been propagated to lemon, mandarin and orange to assess immediate reactions and short-term behaviour in the nursery prior to further evaluation.

Dwarf citrus and the exocortis virus: This Department has established a world lead in the transmission of the dwarfing factor associated with the exocortis virus which reacts with trees propagated on *P. trifoliata* rootstock. The technique has allowed the development of high density plantings of small trees with associated economic advantages.

A 1961 planting of Washington Navel oranges at Yanco A.C.R.C. was inoculated at various ages with both a dwarfing budline and a known severe strain of exocortis (scaly butt). The effectiveness was greatest when trees were inoculated in the nursery before planting out, and after 12 years the canopy surface area was reduced by 67 per cent and 50 per cent for severe exocortis (scaly butt) and dwarfing (non-scaling) inoculations respectively. Later inoculations were progressively less effective. For the most part the yield of trees was closely related to tree size so that dwarfed trees were as efficient on this basis as normal trees.

Phytophthora-resistant rootstock trials: The search for superior rootstocks resistant to phytophthora root rot includes a trial planted at Yanco A.C.R.C. in 1965 to assess the compatibility and performance of St Ives Valencia, Ellendale tangor, Emperor mandarin and Lambert Eureka lemon propagation on a range of locally bred and selected citranges, Ruby Blood nucellars and smooth Sevilles. Most interest in the trial has been with the Lambert Eureka scion because of known compatability problems with *P. trifoliata* and citrange rootstocks. A number of hybrid rootstocks were eliminated but two were compatible and named Benton and Bowman. Benton appears to be the most promising, is of moderate vigour and highest in production. Smooth Seville rootstocks were successful with lemon, but not with Valencia orange and were not used with mandarins. Ruby Blood rootstocks were the most vigorous but, except for the lemons, had low yields. The Benton citrange proved to be the most efficient rootstocks for the group of scions tested to the present stage of the trial.

Quality and Crop Control

Tree spacing and management: In a Valencia orange trial established in 1960 at Dareton Horticultural Research Station, double planted trees again outyielded normally spaced trees on an area basis. In 1969, hedging treatments were introduced to half the trial where all trees are on the vigorous sweet orange rootstock.

The truncate triangular form modified the alternate bearing habit, with a higher yield in the 1971 off-crop, but gave little overall difference from unhedged trees in the three years after treatment.

Abscission chemicals to aid mechanical harvesting: Investigations to induce abscission with Valencia oranges as a preliminary to the development of mechanical harvesting were continued at Gosford. Again cycloheximide was promising and in conjunction with a polyethylene emulsion, it was possible to reduce the concentration from 20 ppm to 10 ppm. This still gave a peak reduction of pull force 5 to 7 days after application but reduced the fruitlet fall and leaf drop side-effects. Similar trials were conducted inland at Yanco A.C.R.C. and Dareton H.R.S., but under the hot dry conditions experienced the results were not as conclusive.

Nutrition: A nutrition trial was commenced in 1965 at Narara Horticultural Research Station to study the effects of various nutrient levels on uptake, tree health, yield and fruit quality of Valencia oranges on *P. trifoliata* grown in large pots.

The rate of nitrogen application has been the dominant influence affecting most characteristics measured. Leaf analyses have shown consistent relationships with application levels of nitrogen, potassium and magnesium but other factors such as fruit quality have varied from year to year indicating an overriding influence of seasonal climatic factors.

A large-scale field trial of Valencia oranges on Troyer citrange and sweet orange rootstocks was planted at Dareton H.R.S. in 1968. The design provides four levels each of nitrogen, phosphorus and potassium and also allows for two cultural treatments. After calibration of trees, the fertilizer treatments were commenced in 1970 but there has been little response to treatment at this early stage.

Rind Blemish Investigations

Studies to evaluate the use of artificial windbreaks in reducing citrus rind blemish were commenced at Mangrove Mountain in 1971. Polypropylene and later polyethylene weave was used in a 5.5 m high windbreak in a Valencia orange planting.

The degree of protection decreased with distance from the windbreak. Wind was reduced 50 to 60 per cent on the leeward side at a distance equal to height of the windbreak, and reduced by 10 to 20 per cent at a distance 7 times the height.

A strong relationship has been shown to exist between distance from the windbreak and yield, fruit size, and blemish. The 1972-3 harvest showed that this windbreak protection had improved yield by 27 per cent with a 6 per cent improvement in packout figures.

Post Harvest Wastage

Storage of lemons: A simulated export trial with Eureka lemons was conducted to compare the effects of time of harvest and G.A. tree sprays on rind colour and fruit condition after 6, 8 and 10 weeks storage.

Lemons were picked in mid-May, early June, late June and mid-July, covering the main crop export season. G.A. sprays in mid-April delayed colour development for all harvests and fruit retained a lighter, fresher colour. All fruit was of acceptable export quality, but the G.A. sprays showed a particular application for late harvested fruit in presenting a better appearance to the buyer.

Quality of Valencias after controlled environment storage: When Valencia oranges of good quality were harvested in mid-season and stored for 5 months, results showed that air storage at 5°C produced far less *Penicillium* (green) mould than the other treatments at 10°C but generally developed more *Alternaria* centre rots, suggesting that the higher temperatures may have some controlling effect on this disease.

Controlled atmosphere at 10°C resulted in the highest level of *Penicillium* mould, *alternaria* rots and dead buttons, but where ethylene free conditions were imposed, the incidence of these disorders was reduced, although results were still inferior to air storage.

Orchard application of benomyl: An investigation is in progress to show the effect of benomyl applied as an orchard spray to Valencia oranges before picking on subsequent fungal wastage after harvest.

Pest and Disease Control

Red scale: Red scale continued to be a pest of major significance to citrus in the M.I.A. Beneficial parasitic insects including *Aphytis chrysomphali* and *Comperiella bifasciata* have been exercising significant control during a succession of recent mild summers. The hot dry summer of 1972-3 saw a

major resurgence of red scale, and reduction in the parasite populations, however, *Aphytis melinus*, which had been present for some time in the Lower Murray, was released in Yanco and Griffith and was found to survive the hot weather.

Study blocks of citrus were established during 1972 at Yanco A.C.R.C., Griffith V.R.S. and Dareton H.R.S. to develop the concept of integrated control by studying the relationship between red scale and its natural enemies when insecticides are withheld for several years. In later years, the effects of intervention with minimum impact sprays will be investigated.

Fruit fly disinfestation: On the basis of earlier results presented from previous investigations at the Gosford Citrus Wastage Research Laboratory, New Zealand quarantine authorities, and several other countries importing Australian citrus fruit, accepted ethylene dibromide (EDB) fumigation and cold sterilization as suitable disinfestation treatments against Queensland fruit fly. Further efficacy trials, necessary to meet Japanese quarantine requirements, have commenced at Gosford C.W.R.L., in conjunction with similar investigations on Mediterranean fruit-fly being undertaken in Perth. These are part of a continuing programme being carried out for the Fresh Fruit Disinfestation Committee in developing disinfestation treatments for important markets. The construction of a new laboratory at Gosford for disinfestation work will provide improved facilities for EDB fumigation and cold sterilization studies.

Washington navel orange decline and stubby root: Tests with a number of rootstock seedlings showed that under sterile conditions no problems of decline occurred, but in periodically waterlogged untreated seed bed soil all types declined. When drainage was improved some rootstock types recovered. It is necessary to determine the nature of this soil factor in relation to this serious problem of decline in replant situations.

Economics

Market outlook: Examination of the market situation for grapefruit suggests a favourable outlook provided that quality standards are maintained. Developments of technology for the utilization of grapefruit as well as competing fruits, particularly for fruit juices, are expected to have a large influence on longer term demand developments.

Double plantings: A study has been initiated to evaluate the relative profitability of a Valencia double planting trial at Dareton. Production per hectare was greater with the double planting treatments. The data indicated that on per hectare basis double planted trees would take more time to pick. On balance, the value of the extra production would more than compensate for the additional picking cost.

TROPICAL FRUIT

Nutrition — Bananas

Potash, magnesium and manganese interaction: A sand culture experiment at Alstonville Tropical Fruit Research Station, established in 1970 in collaboration with the Biological and Chemical Research Institute, Rydalmere, showed that low K supply reduced bunch weight more than low Mg and high Mn. At 6,000 ppm in leaf dry matter, Mn was not toxic but reduced by 50 per cent the green life of fruit held in an ethylene free atmosphere at 20°C.

Irrigation

Sprinkler irrigation — bananas: At Alstonville T.F.R.S. the long-term effects of sprinkler irrigation confirmed the findings of a trial conducted between 1968 and 1970 that, as the available water to the plants increased, the yield response increased. A cost analysis conducted in collaboration with the Division of Marketing and Economics, set guidelines for the conditions under which it is economic to irrigate bananas.

Trickle irrigation — macadamias: A long-term investigation is being conducted from Alstonville T.F.R.S. to study the effects of a series of water applications on growth and yield of Macadamias at Dunoon, via Lismore.

Crop Control

Avocado cincturing: At Alstonville T.F.R.S. the complete removal of a 6–12 mm wide ring of bark resulted in higher yields of Fuerte avocado. Limbs that were cinctured produced more total fruit and more small fruit (225 g) than the control branches.

Maturation

Avocado maturity testing: Chemical and physical indices are being correlated with maturity (consumer acceptability using taste panels) in studies centred at Wollongbar Agricultural Research Centre.

A comparison of methods of oil extraction from avocados has shown the reliability of the refractive index method for oil determination. Preliminary results indicate that there may be a good correlation between dry matter and oil content of flesh.

Post Harvest Research

Transport and storage – avocados: Preliminary investigations in collaboration with the CSIRO Division of Food Research, have shown that polythene bags with an absorbent (potassium permanganate) extended the life of late maturing Hass fruit by several weeks. Control of fruit rots, particularly anthracnose, will have to be overcome before long-term storage can be recommended.

The removal of ethylene from storage spaces using ultra violet lamps, was further developed. The study revealed that a wide range of pollutant gases such as carbon monoxide, mercaptan, hydrogen sulphide and ozone, can also be removed by this means.

Delayed harvesting – bananas: While carrying out investigations at Alstonville T.F.R.S. in collaboration with the CSIRO Division of Food Research, it was found that physiological levels of ethylene could be produced from plastic films used for bunch covers and exposed to sunlight.

Fungicidal treatment of mangoes: The B.C.R.I., Rydalmere, carried out preliminary investigations to control anthracnose (*Glomerella cingulata*) in packed mango fruit. Immersion of fruit for 5 minutes in 1,000 ppm benomyl solution heated to 55°C gave the best results.

Ripening – bananas: Studies in banana ripening in Alstonville T.F.R.S. have examined changes in skin colour and pulp firmness of summer and autumn fruit under a series of ripening and post ripening storage temperatures.

Results showed that the life of fruit after harvest was mainly determined by the temperature at which ripening was commenced.

Satisfactory results were achieved by commencing ripening at about 17°C.

The conditions under which abnormal banana ripening ("green ripe") occurs are being investigated in co-operation with the CSIRO Division of Food Research. The disorder can be prevented by removing ethylene from the environment. Affected tissue is being examined by electron microscopy to find out more about the disorder at a subcellular level.

Plant Protection

Disease control of avocado: Root-rot, caused by the fungus *Phytophthora cinnamomi*, is the most serious disease affecting avocado trees growing on the North Coast of N.S.W. A long-term investigation at Alstonville T.F.R.S., in collaboration with the B.C.R.I., Rydalmere, has been initiated to find out if soil amendments which are sources of exchangeable calcium, and organic mulches will increase soil micro-organisms which are antagonistic to *P. cinnamomi* and thus control the disease.

Banana weevil borer: Investigations are being conducted from Alstonville T.F.R.S. testing insecticides to replace dieldrin for the control of banana weevil borer in areas where dieldrin resistance has developed. Pirimiphos-ethyl, chlorpyrifos and fensulfothion have consistently shown the best results in field trials.

The B.C.R.I., Rydalmere, in collaboration with Alstonville T.F.R.S., has shown that dieldrin resistance is present throughout the Brunswick, spreading widely in the Tweed and increasing in the Richmond. No resistance has yet been detected in the Clarence, Nambucca and Coffs Harbour regions and dieldrin is recommended for control in these areas. Bioassay investigations were carried out to determine the response of strains of banana weevil borer from plantations never treated with dieldrin. Variations in susceptibility to dieldrin between strains were detected and weevils collected in spring were more susceptible than those collected in autumn.

Mango diseases: Investigations are taking place at Alstonville T.F.R.S. in collaboration with the B.C.R.I., Rydalmere, to test a number of fungicides for control of anthracnose in mangoes. Benomyl in oil and maneb have shown promise in increasing fruit set.

Physiological disorders – bananas: The soilborne pathogen *Fusarium oxysporum*, has consistently been isolated from plants affected by split corm. The absence of hot and dry conditions did not favour the expression of symptoms in banana plantations.

Growth in association with micro-organisms – macadamia: Leaf mould from mature Macadamias can enhance growth of young seedlings. An investigation centred at the B.C.R.I., Rydalmere, was commenced to study seedling growth in association with micro-organisms in the soil and rhizosphere. Extracts of soil and roots will be analyzed for presence of growth stimulants.

GRAPES AND WINE

(See also section dealing with irrigation and drainage)

Pruning, Spacing, Trellising

Retrellised Semillon vines were pruned to four levels of severity, balanced according to vigour. The T trellis caused yield increases, although overall the crop was low compared to 1972 following retrellising in 1970. Pruning according to the weight of dormant wood offered no obvious advantage and there was no economic advantage of 1.2 m-wide trellises.

Gordo Blanco vines, from which inflorescences were removed in the two previous seasons were allowed to crop this year and major differences could still be measured between the 1.2 and 2.1 m spaced vines due to the inability to fully extend the arms on the widely spaced vines.

The 1.5 x 1.5 m spaced vines in the vine density trial at Griffith V.R.S. continued to produce the highest yields and economic advantages of close within the row vine spacings were indicated. Economic data which were collected from this block will be used to build a model of costs for a wide range of row and vine spacings and trellis dimensions.

Trellis Drying of Sultanas

Heavy rains at vintage in 1973 resulted in many commercial dried fruit growers adopting the technique of trellis drying. Research at Dareton H.R.S. showed that traditional trellising methods were inadequate for optimum results from trellis drying. Four fruiting wires plus one foliage wire produced the best quality fruit and reduced drying time. Drying rate was increased by the use of two rather than one spray application.

Table Grapes

In a table grape storage trial at Griffith V.R.S. the traditional storage preservatives (sulphur compounds) are being compared with preharvest applications of the fungicide Benlate for effect on stored fruit quality.

At Dareton H.R.S. it has been found for the cultivar Sultana that the largest bunches are achieved by girdling, removing all but 15 bunches from each vine, and all but six laterals from each bunch.

Irrigation

Four pruning levels (20 to 160 shoots per vine) were superimposed over 8 irrigation treatments, including five trickle treatments. Under severe moisture stress, vines with intermediate shoot numbers bore the higher crops, but under conditions of adequate soil moisture crop load was proportional to shoot number. Severe stress also reduced total crop. Trickle irrigation every second day from veraison to harvest resulted in lower crops than trickle irrigation from budburst to veraison and furrow irrigation on a 15-day rotation throughout the year.

Winemaking

The new pilot winery at Griffith V.R.S. was used for the first time to compare fruit from the irrigation trial and to assess the suitability of newly imported cultivars under M.I.A. conditions.

Phenological Data Collection

To determine the relative suitability of cultivars for the M.I.A., collection of phenological and developmental statistics has continued. A complete evaluation of each cultivar was allowed by the production of small volumes of wine from each.

Grapevine Root Studies

Total root growth of four-vine cultivars growing in a root observation chamber at Griffith V.R.S. was greater on heavily pruned vines than on lightly pruned vines. Two periods of rapid root growth were defined — one at the decline of active shoot growth and one following harvest. Root pruning and depletion of soil moisture promoted root growth.

Virus Diseases

A number of clones of twenty cultivars selected from several N.S.W. areas have been heat treated for 80–500 days at the B.C.R.I., Rydalmere. Difficulties in indexing for yellow speckle virus have been met. Present results confirm that heat treatment times of 140 days or more are necessary for the elimination of fleck virus although longer periods are required for leaf roll elimination.

Nematode Resistant Rootstocks

The rootstock cultivars Schwozzman, Dogridge, Salt Creek and 1613 increased berry size and yields of Shiraz scions over the same ungrafted clone of Shiraz.

Economics

Market outlook: An assessment of the market situation for Australian wines suggests that new export markets will need to be developed for the expected increase in supplies of wine grapes. U.K. imports of Australian wine are expected to fall. On the other hand, good prospects exist for expansion of sales to the North American market and to markets in South East Asia. Also, the domestic market is expanding.

Mechanical harvesting: Preliminary estimates of the economics of mechanical grape harvesting in the Hunter Valley indicate that grapes may be harvested mechanically for approximately half the cost of handpicking. For the main part these estimates are based on U.S.A. experience and hence further adaptive research for the Australian situation is planned.

STRAWBERRIES

At Narara H.R.S. new varieties are being produced by selection of seedlings from crosses for comparison with imported varieties. Eight new selections, four previously selected seedlings, together with Torrey, Sequoia and some new imported varieties are under continued observation.

Some of these new varieties and selections were examined for adaptability to tableland growing conditions at Bathurst A.R.S. Of the varieties tested Redgauntlet produced the heaviest crop whereas the two coastal bred varieties, Nared and N67/5 cropped poorly.

A project to examine the influence of time of planting of cool-stored strawberry plants compared with fresh plants was initiated in 1972. There was no difference in subsequent yield between the cool-stored and the fresh planting material but the cool-stored plants produced high numbers of unwanted runner plants.

The screening of chemicals for control of grey mould on strawberries after picking is continuing.

ORNAMENTALS

The testing of fungicides for the control of diseases of ornamentals was continued at the B.C.R.I., Rydalmere. Benomyl, thiabendazole or thiophanate-methyl controlled *Glomerella* dieback of camellia when used as soil drenches, with thiabendazole also showing a stimulatory effect on plant growth.

Studies on the effect of the source of fertilizer nitrogen on the incidence of *Phytophthora cinnamomi* root-rot showed that plants supplied with ammonium or nitrate nitrogen only were less affected with root-rot than those fertilized with a mixture of both forms of nitrogen.

Studies on the vegetative propagation of waratah (*Telopea speciosissima*) have been initiated at Narara H.R.S. Results to date indicate that the fungicide benomyl interacts with high levels (2,000 ppm) of indolylbutyric acid (IBA) resulting in a high rate of root development in cuttings. This work is continuing with experiments aimed at establishing optimum levels of IBA and benomyl, the best time of year for taking cuttings, the determination of time of floral initiation and the determination of the optimum levels of nitrogen, phosphorus and potassium for maximum growth in containers.

IRRIGATION AND DRAINAGE

IRRIGATION MANAGEMENT

Moisture Stress and Water Use

Over the past three seasons, irrigation layout comparisons have been conducted with maize and grain sorghum crops at Leeton Agricultural Research Station. Two contrasting soil types have been involved. Results have shown that with good management there is little difference in yield and water use whether sowing in hills or on the flat.

Row spacings of 36 cm and 71 cm were compared for irrigated grain sorghum grown on the flat. Crop performance was similar for both spacings.

Irrigation requirements of sunflowers are currently under examination in a research programme at Leeton A.R.S. Particular emphasis is being placed on the development of techniques for characterizing plant moisture stress in the field. In an experiment examining times of final irrigation, sunflowers have demonstrated the ability to respond to water application during late stages of growth.

In further work at Leeton A.R.S., lucerne cultivars Lahontan and Hunter River were more productive and had greater longevity under flood irrigation than cultivars Du Puits and Siro Peruvian. Survival rate of lucerne was lower in flood irrigated plots than dryland control plots.

Trickle Irrigation

Water requirements of trickle irrigated apples, peaches, grapes and citrus have been under study at Yanco A.C.R.C. since 1969. Plant performance is being studied under four watering treatments, with and without polythene mulch. In general, response to mulch has been more pronounced than response to irrigation treatments. In the fourth year peaches and citrus have given high yields. Trickle irrigation has produced yields substantially higher than would be expected from 4-year-old trees.

A trickle irrigation trial with prunes has been commenced in the Young district. The project is being undertaken, with funds provided from the Dried Fruits Research Fund, to determine whether significant improvements can be attained in fruit size and cropping with the use of the limited supplies of water available in the district.

TILE DRAINAGE

The design criteria for tile drainage installations on the M.I.A. have been tested over a number of years at Griffith V.R.S., The critical levels and duration of water table situations likely to cause injury to canning peaches, oranges and grapes are being investigated.

Results indicate that peaches are very sensitive to high water table situations (within 45 cm of the soil surface).

An experiment to examine the effectiveness of slotted P.V.C. contour pipe as an underground drainage conduit has also been initiated at this station.

CROPS AND CROP PRODUCTS

VEGETABLES

Beans

Breeding work was continued by the Agronomy Unit, Hawkesbury Agricultural College, developing cold tolerant semi stringless and stringless types for the fresh market and the processing industry. During the year twenty-eight crosses were made, for evaluating against cold tolerance, resistance to summer death and rust.

Tests continued with green, wax, dry edible and lima beans against summer death, clover stunt and rust diseases, and a large collection of disease-free nucleus material is being maintained at the B.C.R.I., Rydalmere.

Plant population studies conducted at Grafton indicated that processing type varieties if sown to a range of high plant density, combined with nitrogen fertilizer applications at high rates, will increase yields significantly.

Amongst thirty-six herbicides tested for weed control in stringless beans at H.A.C., Lasso (alachlor) at 2 l/ha applied as a pre-emergency spray gave the best result. It controlled grasses and broad leaved weeds effectively.

Cabbages

Workers from the B.C.R.I., Rydalmere, continued their programme to obtain information on materials and methods of protecting the crop from pest damage without destroying useful parasites and predators. *Bacillus thuringiensis* sprayed on the crop by itself and in combination with the chemicals — chlordimeform and tricyclohexyltin hydroxide — shows promise in the development of a pest management programme. A mathematical model predicting populations of the cabbage white butterfly is being developed.

Cauliflowers

Following trials carried out at Bathurst on club root disease it is recommended that the fungicide quintozone now be included as a control measure.

Trials continued on packaging methods for the Sydney market.

Substantial advantages were found in trimming the heads. Litter problems at the markets and at retail level were largely overcome and transport cost, per head, considerably reduced.

Lima Beans

Trials conducted for 2 years at Alstonville T.F.R.S. indicate that the crop could be grown satisfactorily in the subtropical environment of the North Coast.

Mushrooms

Investigations carried out at the B.C.R.I., Rydalmere have found that bacterial blotch is caused by more than one organism. Application of bacterial antagonists proved highly successful. Further work is in progress to determine methods, times and rates of application of the three bacterial antagonists involved.

Onions

Herbicide weed control investigations continued at H.A.C. Best results were achieved by using a combination of herbicides.

Potatoes

Breeding work continued at the Agricultural Research Station, Glen Innes. Over 1,000 new crosses were made in the nursery, involving 48 parents of Australian and American origin. Selection work continued up to fourth year seedlings assessment. Seventy-five lines were tested in the preliminary yield trials and fifteen lines in the advanced yield trials. Screening of first year breeding seedlings against common scab, as well as cooking quality tests of advanced breeding lines continued at Orange A.R.S.

Spacing and density studies were carried out at Orange A.R.S. to produce suitable tuber sizes to suit the particular requirements of both the fresh and processing markets. Fertilizer trials indicated that yields improved with increasing levels of P up to 72.3 kg/ha. Similarly the application of N also increased yield. However, in one trial it was found that high application of N could reduce specific gravity.

Sweet Potatoes

Varietal evaluation trials at Alstonville T.F.R.S. indicated that the American pink and orange flesh types especially L8-92 were superior in yield and eating quality to the White Maltese (white flesh) commercial variety.

Identification of virus diseases continued at B.C.R.I., Rydalmere. Virus particles, 750 nm flexuous rods, were found in two varieties which showed ringspot and vein-banding symptoms. Bunchy top disease, which reduces plant growth severely, was found to be associated with a mycoplasma in the phloem cells of the stem. Plants of the Coleambally variety were freed from virus symptoms by applying heat therapy on small tip cuttings. Similar treatment was unsuccessful with the White Maltese variety.

Tomatoes

At H.A.C. the breeding programme continued to develop disease resistant F_1 hybrids and varieties for the fresh market. With the co-operation of the B.C.R.I., Rydalmere, disease testing techniques were evolved to test breeding lines against combined resistance to *Fusarium*, *Verticillium* and nematodes. Selection work continued with advanced early and mid-season maturing lines suitable for the fresh market.

Direct seeding trials conducted at H.A.C., Cowra and Mudgee, using surface mulches under overhead irrigation, indicate that mulches such as bitumen, vermiculate and perlite limited soil surface hardening and cracking and promoted better seed germination.

Weed control work at H.A.C. showed that amongst 18 herbicides tried, a new product "Bayer 6443" (Sencor) 2-3 kg/ha incorporated prior to transplanting gave best results against broad-leaf weeds and good results against grasses. It showed promise also as a standby post-transplant treatment at 0.5-1 kg/ha.

The Sclerotinia disease investigation continued at Rydalmere and Cudgen. The use of benomyl as a control measure is now recommended by the Department. The effect of benomyl - white oil interaction is being further studied as a control measure in this disease.

Field trials continued from Rydalmere aimed at control of root-knot nematodes. Nematicur P is now registered for the use against nematodes and a second chemical, prophos, is currently being considered for registration.

Fruit dipping, using dimethoate to kill fruit-fly larvae is being investigated at Gosford C.W.R.L.

TOBACCO

Nutrition

Investigations continued on the coarse granite sand soil at Ashford to determine the most suitable form and amount of nitrogen fertilizer for tobacco and whether this could be applied as a single dressing at transplanting time. The best yields were obtained at 45 kg N/ha, applied entirely in the nitrate or

ammonium forms or as a 50/50 combination of nitrate and urea. All forms depressed yield when N was applied at 90 kg/ha. Under the 1972-3 conditions of relatively slight leaching a single dressing of N at transplanting was sufficient.

Interactions between N, P and K were investigated on both coarse granite sands and sandy loam soils. It was apparent that commercial fertilizing practices may result in luxury levels of nutrients on the sandy loams as for the second year in succession, yield of cured leaf showed no significant response to fertilizer.

It is too early to draw conclusions from the trial on the coarse granite sand, however investigations will continue to determine the annual rate of nutrient build-up in the soil, and ultimately, the maintenance requirements for N, P and K.

Variety Evaluation

Of the 10 varieties compared on the coarse sand soil in 1972-3, Coker 258 and the registered variety N.C. 95 gave the highest yields (3 357 and 3 221 kg/ha respectively). Coker 258 may be considered as a replacement for N.C. 95 as it has similar disease resistance and is less liable to shed leaf under certain growing conditions. The varieties N.C. 2326, Speight G7 and Hicks, Victorian showed promise.

Disease Resistance

Twelve advanced lines from the CSIRO tobacco breeding programme were evaluated for disease resistance to the APT2 strain of blue mould (*Peronospora tabacina*) and to brown stem rot (*Phytophthora nicotianae* var. *parasitica*). When compared to the standard (Hicks Q.46) only three varieties showed any degree of resistance to blue mould. Two of these also exhibited some resistance to brown stem rot.

Nutrition

COTTON

A 2-year survey is being conducted to investigate zinc nutrition in Namoi Valley cotton soils. Results to date indicate that there is no zinc deficiency in these soils except in isolated sites where heavy grading has removed the surface soil.

Physiology – Agronomy

Narrow row cotton: Research at Narrabri Agricultural Research Station has confirmed the earliness claimed for “Riverina Poplar” and shown the added advantage of using an early variety sown in narrow rows. It has also shown that the sowing rate is very important as a high sowing rate, around 120 kg/ha can depress yield.

Time of sowing: In trials run over two years it has been shown that yield is depressed by late sowing. The optimum time of sowing in the Namoi Valley appears to be early October. Earlier sowing than October increases the risk of frost damage to cotton seedlings.

Growth analysis: In studying the physiological bases of yield it has been established that the first bolls to be set had finished growing 123 days from sowing. This was 30 days earlier than bolls at the top of the canopy. In addition, in the lower portion of the canopy the peak in leaf area index corresponds to the peak in boll growth rate, indicating more efficient production of early bolls.

Verticillium Wilt

Crop sanitation: Chemical sprays are being evaluated to prevent or reduce the formation of microsclerotia of *Verticillium dahliae* in infected plant debris. In order to measure the economic advantages to be gained, work has started to measure and correlate losses with inoculation density of *V. dahliae* in the soil.

Soil biology: The biology of colonies of *V. dahliae* on plant roots in the soil is being studied in relation to the action of organic fungicides and inorganic elements. No suitable agents have yet been sufficiently promising to warrant investigation on a field scale.

Cotton breeding: Some advantage has been made in breeding lines of cotton more tolerant to Verticillium wilt. Field testing will be carried out next season under conventional conditions and further breeding is under way.

Insect Pests

The 1972-3 cotton crop was severely damaged by *Heliothis* larvae. Entomologists from Tamworth Agricultural Research Centre and the B.C.R.I., Rydalmere, in an attempt to combat this and other

cotton pests, have been studying the biology and ecology of *Heliothis*, including D.D.T. resistance in *Heliothis* species.

Biology and ecology: Light trapping was continued throughout the 1972–3 season and provided information on the change in species from *H. punctigera* to *H. armigera*. Analysis of light trap data has shown that lunar phase, wind conditions, cloud and rainfall are important factors affecting populations of these moths.

An intensive study of the cotton crop showed that beneficial insects were sparse, particularly parasites of *Heliothis* sp. The most effective natural mortality agent was a polyhedral virus which attacked larvae in January reducing populations by approximately 80 per cent.

Control methods: Aircraft trials with insecticides, in co-operation with industry personnel, were completed during the season. DDT plus Chlorcam and DDT plus Endrin mixtures gave economic control of *Heliothis* larvae until mid-February. Chlordimeform, which has an ovicidal and an insecticidal action, gave effective control of *Heliothis* until the end of March.

The efficiency of DDT deposition on cotton from aerial spraying was studied at Narrabri A.R.S. Analyses of plant material at B.C.R.I., Rydalmere showed that most DDT was deposited in the tops of densely foliated plants. Frequent sprayings (e.g., 3–4 day intervals) near the end of the season only slightly increased deposits and only slight decrease occurred between sprays.

DDT resistance: Laboratory tests applying insecticides to *Heliothis* larvae have explained the lowered efficiency of DDT in controlling these pests. The tests showed that most *H. punctigera* are killed by a relatively small dose of DDT, but only a small proportion of *H. armigera* are killed by a dose thirty times as great.

OIL SEEDS AND GRAIN LEGUMES

(See also section dealing with irrigation and drainage)

Rapeseed

The potential of rapeseed as an alternative to wheat has engendered particular interest in the crop, especially in southern N.S.W. Agronomic research has concentrated on evaluating both annual and biennial species of rapeseed over a range of sowing times, with studies based at Wagga Wagga, Canberra, Cowra, Temora and Tamworth.

Breeding: A rapeseed breeding programme has begun at Wagga A.R.I. concentrating on developing low erucic acid and yellow seed types.

Time of sowing: Results indicate that in southern N.S.W. rapeseed should be sown about the end of May. Annual varieties sown after this date have reduced yields, whilst biennial varieties sown later than this may not flower. Yields of biennial rapeseed were consistently lower than those of annual varieties. In the dry season experienced, the earlier maturing *B. campestris* (annua) outyielded the *B. napus* (annua) varieties at Cowra A.R.S., in contrast to the results from the previous season, and to the results at Tamworth A.R.C.

Nutrition: Fertilizer studies at a high fertility site near Canberra indicated a response to rates up to 80 kg/ha of superphosphate, with no response to nitrogen fertilizer. Nitrogen application in experiments at Cooma increased protein slightly but gave corresponding decreases in oil percentages.

Weed control: Preplant incorporated herbicides were superior to pre-emergence herbicides, which in turn were superior to post emergence herbicides at Wagga A.R.I. These results generally confirmed the use of trifluralin for weed control in rapeseed. Under the dry conditions experienced, rapeseed was most susceptible to weed competition between 5 and 14 weeks after planting.

Disease: Blackleg is a severe problem in rapeseed in southern N.S.W., as shown by a survey from the B.C.R.I., Rydalmere. Early sown crops are more susceptible to damage. Most infection arises from trash from a crop sown the previous season, hence the need for crop rotation is emphasized. A variety of fungicides is currently being screened for control of blackleg.

Sunflowers

Acreages sown to sunflowers declined markedly in 1972–3 due to low yields obtained by farmers the previous season. Investigations, aimed at evaluating the reasons for these low yields were conducted at Canberra and at Leeton A.R.S., Glen Innes A.R.S. and Tamworth A.R.C. Oilseed crops failed at all times attempted at Canberra, and bird damage was a severe problem with all sunflower experiments in northern N.S.W.

Varieties: Results of variety trials have confirmed that the oil content of sunflowers is influenced more by environment than by varieties.

Time of sowing: The time from sowing to flowering of sunflowers at Tamworth A.R.C. was reduced progressively for sowings made from June to November and increased again for a February sowing. Growth of early sown sunflowers was retarded by the cooler environment. Results suggested that yields of dryland sunflowers sown from mid-spring to late summer are dependent on rainfall at flowering rather than on time of sowing as such. However, at Leeton A.R.S., under irrigation, early sown sunflowers tended to give higher yields than did later sowings, with lower plant populations tending to increase yields.

Oilseed Analyses

A faster and cheaper multisequential method of oil content determination has been developed at Tamworth A.R.C. The method has the added advantages of requiring a cheaper capital outlay for equipment and being more easily adapted to oil quality determination than the standard Butt extraction method.

Measurement of oil contents and quality associated with field experiments on rape, sunflower and soybean have been continued at the B.C.R.I., Rydalmere. This laboratory is continuing its major role in determining protein and oil percentages for the Soybean Co-operative Variety Evaluation Trials conducted by the Queensland, N.S.W., Victorian and Tasmanian Departments of Agriculture and the Universities of Sydney and Queensland.

Soybeans

Factors affecting soybean production were studied at Glen Innes, Tamworth, Narrabri and Leeton Agricultural Research Stations. This included an examination of yields and of flowering of cultivars of varying maturity groups at each site.

Varieties: The lateness of maturity of Hill, Lee and Bragg make these cultivars marginal at Glen Innes A.R.S. The very early maturing cultivars were less productive than were the mid-maturing cultivars, the best of which were Wayne and Bethel.

The yields of Hill and Lee, when sown in October and November at Narrabri A.R.S., were higher than when sown in January. Bragg gave lower yields than these two cultivars for the early sowings, but similar yields for the January sowing.

Agronomy: A reduction in row spacing and an increase in plant density reduced the effects of weeds on soybean yields at Tamworth A.R.C. There was no effect of row spacing on yield in the absence of weeds. Weed competition from *Datura* had little effect on soybean yields when allowed to remain for 6–8 weeks after sowing.

Insect pests: A survey of soybean insect pests indicated that only green vegetable bug, *Nezara viridula* has been of economic significance to date. A number of chemicals are being screened in the laboratory for effectiveness against green vegetable bug.

Lupins

Varieties: The lupin cultivar Uniharvest (750 kg/ha) outyielded Unicrop (680 kg/ha) which substantially outyielded the *L. albus* types WB1 and WB2 (400 kg/ha) at Cowra A.R.S. Variation in the seeding rate from 45 to 100 kg/ha did not affect the yield of Uniharvest.

Nodulation: In a comparison of inoculation treatments at Canberra, lime pelleted lupin seed gave the best nodulation and growth. Rock phosphate pellets and gum slurry pellets also gave better nodulation and growth than did the controls.

Weed control: Simazine (2.0 kg/ha) has proved particularly useful for weed control in lupins in experiments at Wagga A.R.I. The value of the registered herbicide trifluralin has also been demonstrated, though trifluralin reduced secondary and tertiary root development of the lupins. Pre-planting incorporated herbicides were superior to post planting non-incorporated herbicides, which in turn were superior to post-emergence herbicides.

Field Peas

Varieties: Field peas produced yields up to 1 700 kg/ha at both Temora A.R.S. and Cowra A.R.S. The cultivar Dunn outyielded Derrimut, Buchley, White Brunswick and Collegian and gave a yield similar to that of the newly bred cultivars WP3, 4 and 7 and T.R.C.1 at Cowra. Increasing the seeding rates from 67 to 101 kg/ha did not affect the yield.

Nutrition: The yield of field peas was increased by 960 kg/ha by the application of 160 kg/ha of superphosphate on a low fertility site at Canberra.

Mung Beans, Cow Peas

Research at Tamworth A.R.C. has established an optimum sowing rate of approximately 17 kg/ha for mungbeans. The new mungbean cultivar, Berken, outyielded Celera by 15 per cent over all seeding rates.

Cowpeas (950 kg/ha) had much lower yields than did mungbeans (1 700 kg/ha) at Tamworth. The optimum sowing rate for cowpeas was 28 kg/ha.

Economics

Market outlook: Prospects of satisfactory markets for greater levels of Australian soybean production appear quite favourable. It is expected that the demand for whole beans and soybean meal will rise at a much faster rate than the demand for soybean oil. The demand for soyoil is greatly influenced by oil supplies derived from other oilseeds and palm oil.

The market prospects for sunflower both domestically and for export look reasonable, at least in the short term. There is some uncertainty as to expected domestic supplies of sunflower because of limited experience with large scale commercial production of the crop.

New oilseed crops: A study was undertaken to evaluate the potential markets for Sesame, Castor, Crambe, Vernonia, Niger and Mustard oilseed crops. Sesame and Castor appear to have the best potential for development in Australia. Given current farm prices it seems unlikely that the production of these oilseeds will expand in the near future.

Protein meals: Research was initiated to collect information on prices and on quantities demanded and supplied from domestic and overseas sources on a comprehensive basis for the protein meals industry. Some assessment of the principal causal relationships affecting these variables is being made to assist in forecasting prices and quantities and to assist in policy analyses.

WHEAT BREEDING

Wheat Improvement in Central and Southern N.S.W.

Dryland programme: An integrated programme of wheat improvement is conducted at the Wagga A.R.I., Temora A.R.S. and Condobolin A.R.S.

The Temora line M1224-2, mentioned in last report, was released under the name Teal. This soft-grained cultivar is expected to eventually replace Olympic, now fourth in popularity in N.S.W. for midseason sowings in central and southern districts. A feature of Teal is its resistance to Septoria leaf blotch so troublesome in wet years in the south.

Two other Temora bred wheats, Falcon and Eagle, are the basis of the N.S.W. Southern Hard premium grade which is of increasing importance in the industry. With 212 000 metric tonnes delivered this grade was by far the largest premium class in this state in 1972-3, though usually the greatest quantity of premium wheat comes from northern districts.

Improvements on some agronomic and quality features of Falcon and Eagle have been sought in a long-term programme designed to produce superior semidwarf wheats. The stage has now been reached where two hard-grained crossbreds have successfully completed field and laboratory tests. The crossbred DARF PA 134-2 is a short-strawed backcross derivative of Eagle and, like that cultivar, possesses the valuable stem rust resistance translocated from *Agropyron elongatum*. The other hard crossbred is WW31 or "7147", a short-strawed, fully bearded and particularly free-milling type. It is derived from the wheat WW15, introduced from Mexico in 1963. The red-grained WW15 has shown outstanding yielding ability under a very wide range of conditions both in Australia and overseas and it has been independently released as a new cultivar in no less than three countries in the past year.

In future, it is intended to more fully exploit inherent varietal differences in grain protein percentages. Knowledge of this aspect of quality is limited and experiments were initiated to provide data on which a breeding programme could be based.

For some time, growers have been seeking cultivars adapted to very early and early sowings. This requirement has led to the selection of winter derivatives of WW15 which, in outyielding all other crossbreds at Wagga and Temora, gave a most encouraging preliminary performance. This material is being further evaluated in widespread trials.

Continuing genetic studies have isolated and identified a fourth gene, designated Vrn 4, that inhibits the winter habit of growth.

The incorporation in new cultivars of resistance to several diseases which are, or could be, problems in the south is receiving attention. Flagsmut and Septoria leaf blotch are considered while the bunt resistance investigation commenced in 1972 is being continued. The genetic base of rust resistance should be broadened by future crosses with rust resistant semidwarf cultivars from India.

A start was made on mutation breeding work at Wagga A.R.I. This will be evaluated for some years in comparison with conventional breeding programmes.

Of new cultivars from other States, Halberd performed particularly well and Darkan and Bokal maintained their good yield record of previous years. Despite this, it is now certain that these varieties will not be recommended in N.S.W. due to grain and/or quality defects which have come to light.

Irrigation wheat programme: Based at Wagga A.R.I. this programme involves field testing in the Murrumbidgee and Coleambally Irrigation Areas and some preliminary trials at Yanco A.R.C. and Leeton A.R.S.

The soft-grained crossbred, WW36, a product of the semidwarf improvement project mentioned earlier, passed its final quality tests and again showed a yielding ability markedly superior to cultivars now grown under irrigation. Seed of WW36, a derivative of WW15, is being multiplied by registered seed growers in anticipation of its recommendation for irrigation areas in 1974.

Steps are being taken to incorporate more genes for stem rust resistance in WW36, which, unfortunately, is expected to become susceptible to new rust races within a few years. Also, as a precaution, other material with suitable quality and more reliable rust resistance, is being prepared for release, even though this material does not as yet equal WW36 in yield.

In one of three variety x nitrogen trials, N application gave large increases in yield; semidwarfs generally responded more than other wheats. This year these trials include time of sowing treatments and closely related semidwarfs of different phasic development. Such work may help to specify the requirements for maximum yield responses to nitrogen.

Wheat Improvement in North Western New South Wales

This programme is based on the Tamworth A.R.S., supported by field testing at Manilla, Quirindi, Gunnedah, Narrabri, Moree and Coonamble.

Bread wheat: The bread wheat improvement project is being carried forward on a reduced scale. Although irrigation was used to produce some good yields in preliminary trials at Gunnedah and Quirindi, dry weather at other centres greatly hampered progress. All new strains in advanced yield tests were discarded because none were found to be superior to Tarsa in field and quality characteristics.

In early generation—selection the emphasis was on frost resistance. The introduction of frost resistance into good agronomic backgrounds will continue to be the main aim of the programme.

Durum wheat: Five durum lines which appeared equal or better in quality and yield to Duramba in 1971 trials were found to be inferior to Tamworth grown North American cultivars in limited quality tests. Their deficiency was most marked in semolina mill yield and semolina yellow pigment content. It is concluded that the main objective in the durum programme at this stage must be the incorporation of better quality traits in the local early-maturing semidwarf material which is otherwise desirable.

The Australian Wheat Collection

The collection, inaugurated nearly 5 years ago at Tamworth A.R.C., now holds approximately 16,000 samples. In the year under review, usage increased greatly, a total of 3,146 entries (compared to 792 in the previous year) being supplied in response to 114 requests by 50 different workers in Australia. During the same period, 323 entries (201 in the previous year) were supplied in response to 17 requests from 14 overseas countries. Imports dropped from 374 to 339 samples but there was an increase in the range and selectivity for the samples sought.

Automatic data processing is being applied to the collection to build data banks, eventually four, with one subsidiary.

Special sowings at Tamworth A.R.C. and other centres are being made for collection of data, 17 batches each of 500 samples being distributed this year for this purpose.

WHEAT CROP PHYSIOLOGY

Wheat Frost Injury

At Tamworth A.R.C., frost injury research was extended to field studies of ice nucleation and crop temperature relationships. Studies of the influence of simulated frosts on crop photosynthesis were commenced. Early results showed that frosts reduce subsequent daily photosynthesis.

Screening of 102 wheat varieties revealed none which were superior in pre-heading stages to the Cheyenne derivatives currently being used as parents in the breeding programme. Considerable variation was observed among 300 wheat varieties in post-heading frost resistance.

Genetic experiments in co-operation with the University of Sydney using the Chinese Spring/Cheyenne chromosome substitution series indicated a strong association between frost resistance and vernalization response conferred by chromosome 5D.

Drought Resistance and Water Use Efficiency

At Wagga A.R.I., studies of water relations were continued. A physiological method of assessing drought resistance was developed. No differences using this method were found in the drought resistance of 5 varieties, which indicates the environment crop interaction as the main problem.

WHEAT QUALITY

Uniform Quality Testing

In 1973 nine crossbreds and one interstate variety were nominated for examination by the Uniform Quality Testing Committee. They covered a wide spectrum of quality types and together with their respective check varieties, the bulk samples as received at Rydalmere, constituted by far the greatest number of nominations received to date.

Three crossbreds, one biscuit line and two bread lines, all from the Wagga-Temora breeding programme are to be considered for registration and recommendation by the August, 1973, meeting of the Standing Advisory Committee on Wheat.

Rapid Methods of Assessment

Nitrogen determination: With Wagga assistance the CSIRO amide nitrogen determination has been adapted to field usage for the Falcon-Eagle hard wheat segregation. Investigations have shown that the test has wider applications to bread, biscuits, rice, oats and other grains.

Tyrosinase activity: Research at Yanco and Rydalmere has resulted in development of a rapid field test for measuring tyrosinase activity. The technique is used for rapid identification of wheat varieties such as Wren, Mexico 120 and crossbred 8156, all of which could present a marketing hazard if grown in N.S.W.

Starch damage: Workers at Rydalmere have developed a rapid and highly accurate method for starch damage determination and this method is now being used in routine laboratory assessment.

Alpha amylase activity: The Yanco-Rydalmere rapid method for measuring alpha amylase activity was further developed during the year using a commercially marketed chromogenic starch substrate. This should become an important routine test for assessing weather damage.

Effect of Bunticide Residues on Baking Quality

Wagga A.R.I. has found that traces of some bunticides have a drastic effect on baking quality through suppression of yeast activity. Investigations are now being undertaken to assess whether there is any contamination of bulk wheat with bunticides and to measure any effects that may occur with baking quality.

Grain Hardness

Moisture content of a porous material varies depending upon its history of wetting and drying, a phenomenon known as hysteresis. The hysteresis effect is being studied with a range of wheats to assess the effect on the measurement of grain hardness.

The correlation between grain hardness and particle size distribution of flours milled from wheat samples was calculated and found to be highly significant. The percentage of flour particles less than 40 microns in diameter is a valuable index for differentiating between hard and soft varieties. The percentages of particles below and above that size appear to be independent of grain protein and environmental influence.

WHEAT PRODUCTION AGRONOMY

Mineral Nutrition

Phosphorus: Further work in the northwest has confirmed that widespread responses to superphosphate can be expected in all but the black and grey cracking clay soils of the plains. Small, visual responses have occurred in these areas but there have been no associated yield responses. Other work based at

Tamworth A.R.C. has aimed at determining the principles of phosphate nutrition in red brown earths with different histories of superphosphate application. Results obtained to date show that most of the native soil phosphorus occurs in the iron bound fraction, while that from recent fertilization has moved in the aluminium bound fraction.

Work in the Central West has aimed at the development of a reliable soil phosphorus test to be used as a basis for fertilizer prediction. The analysis of results has indicated that climatic variables have a significant effect on yield response and hence on the correlation between soil test and yield response. The inclusion of a P/E climatic index has improved the overall correlation considerably.

Preliminary analyses of the data obtained from the 3 years of the pilot regional soil testing service in the South West Slopes region have shown that recommendations based on the test were generally too low in the low rainfall areas but too high in the high rainfall areas. Further examination of the data is being undertaken to improve the predictive value of the soil test. At Wagga A.R.I. the effect on wheat production of superphosphate applied in the pasture phase and of superphosphate applied with the crop on soils of different fertilizer histories is being studied. Results obtained to date indicate that greatest yield response to superphosphate applied with the crop occurred where no pasture topdressing had been undertaken. Most economical grain yields were obtained from 63 to 126 kg/ha applied with the crop.

Nitrogen: Research in the Central West has been aimed at an assessment of the value of chemical methods for the measurement of nitrogen requirements and determining the nitrogen status of the soils. Preliminary analyses have shown some soil correlations but further chemical analyses are necessary. Generally, nitrogen soil tests have not proved reliable as indicators of nitrogen responsive soils.

Results obtained from four seasons' experiments at Wagga A.R.I. are being analysed in an attempt to define critical nitrogen levels in southern wheat soils. Analyses have at this stage shown that seasonal rainfall and levels of readily available nitrogen are the factors most closely associated with grain yield responses to nitrogen fertilizer.

Repeated cropping of irrigated wheats in the M.I.A. has led to the development of nitrogen deficiency in many soils, and a series of 17 trials was laid down throughout the area to determine the most economic rates of nitrogen fertilizer. Positive responses were gained on sites which had grown two or more successive crops immediately prior to the wheat crop. Response curves are being developed to allow the estimation of optimum levels of nitrogen fertilizer. In this work there was a general trend for phosphorus fertilizer to reduce protein levels and for nitrogen to increase levels. Irrigated wheat grown on light red soils in the Macquarie Valley showed substantial responses to nitrogen fertilizer. Research at Tamworth A.R.C. is designed to determine the effect of varying lengths of lucerne ley on soil nitrogen status and soil nitrogen requirements of subsequent wheat crops. Analyses conducted on the soils have shown a definite increase in available nitrogen, particularly in the red brown earths, where there was 30 kg/ha build up of nitrogen after 4½ and 2½ years of lucerne.

Crop – fertilizer production function: A model was developed by the Division of Marketing and Economics for describing crop response as a function of measured soil characteristics, applied nutrients and weather. The function can be used to generate specific fertilizer recommendations to farmers based on soil analyses, it can be incorporated into the operations of a soil testing laboratory, and it can be used in an aggregate analysis of the welfare effects of widespread adoption of the fertilizer recommendations generated by the study. Some initial work has been started on the applicability of the procedure for the wheat areas of N.S.W.

Zinc deficiency: Further work has been conducted to clarify the pattern of responses to applications of zinc on the black soils of the Liverpool Plains. Results indicate that application of zinc will be economic only if residual responses can be obtained. This has been the case on relatively few occasions. Results obtained in the Macquarie Valley have confirmed that zinc is not a limiting factor in dryland wheat production in that area.

Cultivation Techniques

Minimum tillage: Research at Wagga A.R.I. is designed to study crop performance, soil structure and fertility under contemporary methods of cultivation, as compared with the utilization of certain minimum tillage techniques in conjunction with herbicides and fertilizers. Results to date have shown a quite consistent pattern with direct seeding into undisturbed soil giving approximately 80 per cent, and direct seeding with the triple disc drill 60 per cent, of yields from conventional sowing into fallow. In 1972, however, yields obtained from a number of minimum tillage techniques achieved by modification to conventional combine points, were significantly better than those obtained from fallow sowings.

Weed Control

Skeleton weed: Since 1961, a research programme at Wagga A.R.I. has been devoted to the study of the ecology and control of skeleton weed. Factors affecting the population biology, flowering, seed production, germination and vegetative regeneration have been studied in detail, as have been methods of chemical control with particular reference to pre-planting control of the weed. In addition, co-operative work has been undertaken with CSIRO, Division of Entomology in the release of potential

biological control organisms. The fungus *Puccinia chondrillina* has spread quite rapidly and now occurs wherever skeleton weed is found. Current observations indicate that the major Australian strain of skeleton weed is readily attacked by the rust fungus and premature withering of the rosette leaves is common in the drier areas.

Paterson's Curse: Further work at Wagga A.R.I. is aimed at determining the local distribution of Paterson's Curse infestations and reviewing methods of chemical control. The research has emphasized that previously recommended chemical control methods remain satisfactory.

DISEASES OF WHEAT

Take-All

Spore forms, not previously observed, have been found in cultures of *Gaeumannomyces graminis*, the causal fungus of take-all and their function in the ecology and taxonomy of this fungus is being determined. The pathogenicity of 28 isolates of *G. graminis* to wheat and oats was studied in glasshouse experiments and ranged from pathogenic to non-pathogenic on wheat while no infection was recorded on oats. Glasshouse experiments also demonstrated that adding the ammonium form of nitrogen to take-all infected soil resulted in less colonization of wheat roots than when nitrogen was added in the nitrate form. A volatile substance present in soils has been implicated in suppressing the development of the take-all fungus and this volatile occurs at higher concentrations in soils to which ammonium nitrogen has been added.

Cereal Cyst Nematode

Field trials have demonstrated the presence of resistance to this disease in some of the wheat, oat, rye and barley varieties included in the trials. Only one wheat variety was found with resistance while several local oat and rye varieties and two European barley varieties showed good resistance.

Cereal Seed Fungicides

Trials conducted from the Agricultural Research Institute, Wagga Wagga, showed that dexton gave control of bunt equal to HCB. Mankobunt and benlate also provided good control.

Covered smut of barley was controlled by mankobunt, manebunt, vitavax, benlate, and several experimental fungicides. Dexton was ineffective.

Benlate was better than vitavax for the control of loose smut of wheat while vitavax was better for the control of loose smut of barley.

Maneb and ceresan reduced establishment when treated wheat seed was stored for one year before sowing.

WINTER CEREALS, BARLEY AND OATS

The emphasis in barley and oats research is on varietal improvement in grain yield and in herbage production in dual purpose varieties. Selection of lines suitable for grazing is based on comparison of their dry matter production and grain recovery after complete defoliation on one or more occasions. In farming practice less intensive grazing is common. In a new experiment at Temora A.R.S., the effects of stocking rate (20 and 30 sheep/ha) and duration of the grazing phase (0, 2, 4, 6 and 8 weeks) on herbage growth, sheep liveweight and grain production from Cooba oats and Abyssinian barley are being examined.

Plant Breeding Programmes

Barley: Advanced lines from interstate were compared for grain yield with the varieties Clipper and Lara in several trials in 1972. Under high yielding conditions, at Yass, on long fallow at Wagga A.R.I., or under irrigation at Yenda and Yanco A.C.R.C., none of the advanced lines yielded significantly more than Lara, although several were its equal. In some of these trials Lara yielded more than Clipper. Under harsher conditions, as at Dubbo, none of the advanced lines yielded more than Clipper, although several were its equal. These lines are being further tested in 1973.

Many introductions were grown and some selections made, including selections of crossbred lines with tolerance to the leaf disease, scald.

In 1973, trials sown include several early sown trials which will determine the suitability of the newer varieties for grazing and subsequent grain recovery.

Oats: The line M1341, selected at Temora A.R.S. as a replacement for Avon, is being grown by registered seed growers in 1973 in anticipation of its release in 1974. It is an oat variety which yields more than Avon when late sown for grain alone and gives better grazing and grain recovery when sown early or mid-season. It is about 4 days later in maturity than Avon. It has good feed value with a lower percentage husk than Avon but is unsuitable for milling because of its small grain size.

Two other lines from Temora, M1354 and M1365 are in statewide trials. M1354 is a good dual purpose oat but its straw strength is rather weak. M1365 has good herbage production when sown early or mid-season and both grain recovery and ungrazed grain yields are high. Quality testing by industry has shown that this line may be acceptable for milling.

Two lines selected at Glen Innes A.R.S., P4315 and P4319, are undergoing continued testing and further selection for increased uniformity before being made available to registered growers.

The search for a grain type combining high grain weight with a thin husk has resulted in selection of lines equal or better than Swan in grain weight and with a husk percentage as low as that of Cooba. These have been used in the crossing programme at Temora A.R.S. and now new lines are being tested which have this excellent grain quality and are also adapted to the region. Prospects of finding high yielding dual purpose lines, with outstanding grain quality, are good, as grain size is one of the main components determining grain yield.

District Variety Trials

As the season was extremely dry in many areas of the state in 1972, there were again fewer trials sown than usual. Agronomists throughout the state reported results of twenty-five barley variety trials and twenty-two oat variety trials.

Barley: Clipper was again the outstanding variety, being equal to or better than any other in yield. Although the season should have favoured the very early variety Ketch, Clipper proved to be better for late sowing under dry conditions, and a decision was made to delete Ketch from recommendations. The six-row varieties Abyssinian and Beecher often yield less than Clipper, but they are useful for early sowing for grazing as well as for grain. The new Victorian two-row variety, Lara, has as yet undergone only limited testing and has not outyielded Clipper, but this may be a reflection of the dry seasons experienced. It has yielded more than Resibee, the variety currently recommended for early sowing.

Oats: About half the district trials were grazed. The trials included the advanced lines selected at Temora A.R.S. and Glen Innes A.R.S. and recommended varieties. Bundy has not proved better than Avon or Coolabah and may not continue in recommendations. The season demonstrated the advantage of sowing grazing varieties as early as mid-February after good rains, even if an extended dry period follows. These trials are of value in indicating the adaptability of varieties and lines to widely varying conditions from the tablelands to the marginal western areas.

SUMMER CEREALS, MAIZE AND SORGHUM

(See also section dealing with irrigation and drainage)

Maize Breeding

Emphasis has been placed on the development of synthetic varieties involving both locally adapted and exotic material in the maize breeding programmes conducted at Grafton A.R.S. and Glen Innes A.R.S. These synthetics are to provide sources of high yielding disease resistant germ plasm for future inbred and hybrid development.

Test crosses to survey the incidence of genetic resistance to Race T of Southern Leaf Blight have been developed. Conversion of inbreds to a male sterile cytoplasm not affected by Race T of *Drechslera maydis* has commenced.

Two populations incorporating early maturity and general resistance to Northern Leaf Blight *Drechslera turcica* were random mated, and individual plants with the desired attributes were selected. The transfer of the dominant "Ht" gene for northern blight resistance was continued with 28 elite inbreds.

Gene substitution projects aimed at developing high lysine forms of late maturing inbreds; and at incorporating the dwarfing gene "brachytic - 2" to reduce the stature of inbreds; were advanced through further back cross generations at Grafton A.R.S.

Plant Density and Cultural Techniques

Sowing rates ranging from 40,000 to 60,000 plants/ha did not influence the grain yields from 4 maize hybrids at Grafton A.R.S. More lodging occurred at the higher plant densities.

At Tamworth A.R.C. sorghum grain production from rows spaced at 75 cm significantly exceeded yields obtained from 35 cm rows, when site yields averaged 9 quintal/ha. At mean site yields of 34 quintal/ha differences in row width did not materially affect yield.

Soil ripping to 60 cm depths, increased grain yields from irrigated maize grown in the Breeza — Quirindi area. Heavy applications of gypsum as an ameliorant to these soils depressed maize yields.

Grain sorghum establishment in several soil types in the North West was significantly increased by the use of soil compacting press wheels fitted behind sowing combines. In contrast, harrowing after planting decreased establishment in two out of four trials.

The effects on maize establishment of seed soaking, anticrusting treatments for seedbeds, and water injection at sowing are being investigated at Trangie A.R.S.

Plant Nutrition

Studies of the zinc requirements of irrigated maize and dryland sorghum grown on the black-earth soils of the Liverpool Plains indicate that responses to zinc applications are strongly influenced by different seasons. In one trial, zinc oxide soil applications gave better second year maize yields than those obtained from either metallic zinc or zinc sulphate soil treatments. The use of zinc oxide dusted seed plus zinc sulphate foliar sprays increased yields regardless of previous soil zinc applications. These increases were minimized when zinc oxide was used as the prior soil dressing.

Weed Control

Investigations at Tamworth A.R.C. show that grass weeds are responsible for considerable yield reductions in dryland grain sorghum. In low yield situations i.e. 9 quintal/ha, inter-row cultivations gave yields equal to those obtained from weed free conditions. Such treatments were less effective when site mean yields approached 35 quintal/ha. Time of application studies with atrazine indicate that this herbicide is best used as a pre-emergent treatment.

Plant Diseases

Boil Smut: Treatments to eradicate spores of *Ustilago maydis* from imported maize seed, form part of the quarantine procedures adopted to exclude Boil Smut from Australia. Investigations at the B.C.R.I., Rydalmere, have shown that a 5-minute immersion in 100 ppm sodium hypochlorite solutions eliminate spores of this fungus from heavily contaminated seed. Immersion for 30 minutes in 6 per cent solutions of this sterilant has not impaired seed viability.

Southern corn leaf blight: This disease has again caused damage to north coast maize crops grown from seed produced by utilizing "Texas" source cytoplasmic male sterility (T. cms). Field observations and studies with a toxin produced by the causal fungus *Drechslera maydis*, have established that Race T is present in N.S.W. This race was responsible for the 1970 epiphytotic in the U.S.A.

T. cms forms of inbreds N.N. 18 and HB, developed at Grafton A.R.S., exhibited some degree of resistance to the disease. Moderate to highly resistant reactions were recorded with normal cytoplasm inbreds and with lines involving type "C" male sterility inducing cytoplasm. Monitoring plots of normal and T. cms single crosses were used to associate weather conditions with disease outbreaks. The disease was not found in inland N.S.W. maize crops this year.

Insect Pests

Suitable sampling techniques have been developed to assess sorghum midge *Contarinia sorghicola* populations. The population dynamics of this insect are being related to sorghum crop phenology in an endeavour to ascertain flowering dates least liable to midge attack.

RICE

Varietal Improvement

The newly released variety YR6-100-9 was named Baru and the variety YR13-89-9 was released and named Inga. Inga and its sisterline YR13-89-11 are fine long grain varieties having high whole grain yields after milling. They will substantially replace Kulu in the 1973-4 season. Both varieties yield less than Calrose and Baru, but demand a substantial premium for quality. Inga and YR13-89-11 are not suitable for the harsher Murray Valley climate.

A total of 258 advanced selections were yield tested in three combine sown trials at Yanco and in one aerial sown trial at Deniliquin. The high quality long grain selection YR 73-1-7-1 appeared promising and will be widely tested next season. Long grain selections generally did not perform well at Deniliquin.

More than 200 crosses were made in the rice improvement project. In excess of 200 F₂ and F₃ bulk populations and about 5,000 panicle rows were shown for observation and selection.

Pure seed schemes were maintained in conjunction with the Rice Marketing Board for the varieties Calrose, Kulu, Baru and Inga.

M₂ segregates derived from gamma irradiated seed of Inga and YR13-89-11 matured about 2 weeks earlier than the original varieties.

Straw of the varieties Inga was shown to be much more palatable to sheep than that of other varieties.

Culture media were investigated for growth and differentiation of rice pollen cells.

Cultural Practices

Rice nutrition: Low and medium fertility soils, which apparently have fast rates of nitrification, responded to a delayed fertilizer application. Yield increases of 500 kg/ha to 1 000 kg/ha were obtained when the bulk of the fertilizer was applied immediately before permanent flooding. Factors influencing differences in rates of nitrification in different soils are to be studied further.

Continuous rice growing: The second consecutive crop was grown on the experimental site at Leeton A.R.S. Yields were much higher than in the first year but early growth was still very slow. Soil preparation and establishment of both combine and aerial sown rice into rice stubble gave no difficulties. Only minimal cultivation appears necessary. Nitrogen was the only fertilizer element to which rice responded. High rates of up to 155 kg/ha N were required to maximize yields.

Rice cropping had no significant effects on regional ground water levels over a period of two rice inundations and the intervening fallow. The infiltration rate in the heavy soil was in the order of 15 mm/day, which is similar to that found in other heavy soils in the M.I.A. Salinity levels throughout the profile were very low.

Crop Protection

Weed control: Degradation of atrazine applied to summer crops is quite rapid and the risk of damage to rice crops grown in the summer following a treated sorghum crop appears negligible. The rate of degradation in other soils needs to be verified.

Between 70 and 80 per cent of the herbicide molinate applied prior to a flushing irrigation was lost by the time of permanent flooding 24 days later. This loss did not result in decreased weed control. These investigations may lead to a more flexible recommendation regarding time of application.

None of the herbicides tried gave satisfactory control of *Cyperus difformis* in rice stands when applied before flooding. Aerial sown rice was much more sensitive to many pre-emergence herbicides than drill sown rice.

Bloodworm control: Difenphos was an effective organo-phosphate alternative to DDT for seed treatment of rice against bloodworms. An adhesive polymer was effective in improving the adhesion of protectant dusts to rice seed.

Straighthead: The severity of straighthead decreased dramatically with three successive rice crops on a site in Coleambally. This suggests that the problem may be due to toxic or harmful biological agents associated with the pasture rather than to nutrient deficiencies.

Grain Quality

Parboiling: Black marks (peck) on parboiled milled rice may be due to the development of micro-organisms on high moisture grain left in grain handling equipment.

Canning: Canning stability, of parboiled Australian rice varieties with a low amylose content, can be improved by cross-linking rice starch with epichlorohydrin.

Waxy rice: The locally developed waxy rice variety YR140 has excellent Japanese cake quality and it has a good absolute paste viscosity which makes it suitable for use in the food processing industry.

PESTS OF STORED GRAINS

Insecticide Resistance

Maldison: Investigation of maldison resistance in insects infesting stored products in N.S.W. was continued at the B.C.R.I., Rydalmere. Samples of the following major pest species were examined in the laboratory: lesser grain borer, *Rhyzopertha dominica*; rice weevil, *Sitophilus oryzae*; granary weevil, *S. granarius*; rust-red flour beetle, *Tribolium castaneum*; confused flour beetle, *T. confusum* and broad-horned flour beetle, *Gnathocerus cornutus*. Lesser grain borer, the main pest in bulk grain storages, was maldison resistant at sixteen country storages and at Newcastle and Sydney terminals. Maldison susceptibility was recorded at ten country storages and at two seed grading premises. Rice weevil, less

common in samples from bulk storages, was maldison susceptible at four country storages, at both grain terminals and at 4 seed grading premises. Rust-red flour beetle was predominantly maldison resistant, including samples from seven country storages and the Sydney grain terminal. Samples from two farms and three quarantine interceptions were also maldison resistant.

Dichlorvos: Methods of detecting dichlorvos resistance were investigated for three major grain pests. The tests were performed with cultures accumulated from maldison resistance surveys. Contact screening on filter paper indicated dichlorvos resistance in lesser grain borer from the Newcastle and Sydney grain terminals, from bulk grain storages at twelve localities in inland N.S.W. and in a recent sample from an abandoned mill at Rozelle. Cultures from twenty-one localities in N.S.W. and one quarantine interception were diagnosed dichlorvos susceptible. All sixty-six cultures of rust-red flour beetle and twenty-two cultures of rice weevil were susceptible to dichlorvos. A fumigation test, investigated with fourteen cultures of lesser grain borer, has potential for rapid diagnosis of dichlorvos resistance.

Candidate grain protectants: Methyl dursban and phoxim were tested on maldison-resistant cultures of grain pests. No resistance to methyl dursban was evident in rust-red flour beetle but there was cross resistance in rice weevil and lesser grain borer to both compounds.

PASTURES AND FORAGE CROPS

PASTURE ESTABLISHMENT

Most of the current research in pasture establishment is aimed at reducing the high costs involved in establishing improved pastures by conventional methods. Consequently the major projects involve physiological and agronomic studies under non-arable and minimum tillage situations.

Pasture Establishment in Non-arable Situations

Aerial sowing: Over several years on the Central Tablelands lucerne has been outstanding in its production compared with subterranean clover, cocksfoot and phalaris when aerial sown into native pasture. Furthermore the establishment of the perennial grasses has not been reduced by the presence of lucerne.

A survey of commercial aerial sowings on the Northern Tablelands has been conducted. The survey confirmed experimental findings that successful aerial establishment requires adequate ground cover, lack of competition, good soil fertility, and good soil moisture availability. Given sufficient time to develop, most aerial sowings can be regarded as successful even though after 6 months some were classified as unsatisfactory.

An economic assessment of aerial sowing with and without herbicide treatments has been commenced but no data is available as yet.

Pasture Development with Minimum Tillage

Sod-seeding: Work on the Northern Tablelands is evaluating sod-seeding as a means of establishing perennial grasses in bloat prone clover dominant pastures. General Select Phalaris has established better than the ryegrasses, fescues and cocksfoots. A modified sod-seeding boot and sowing in late autumn have also been most beneficial to establishment.

Oversowing: Investigations on the North Coast and in the Central West have shown that a range of temperate legume cultivars can be established successfully by oversowing into native pastures at low seeding rates.

Pasture Establishment in a Clean Seedbed

Research has shown that the use of clean seedbed techniques is necessary for establishing both subtropical species on the North Coast and temperate species on difficult soils of the Southern Tablelands.

Research on the mid-North Coast has defined the optimum sowing time, maximum depth of sowing and the compatibility of some tropical legumes and grasses. The need for high initial plant populations has also been emphasized.

The continuing study into methods of establishing kikuyu from seed on the coast has shown the definite necessity of sowing this species alone and into a clean, well prepared seed bed.

PASTURE NUTRITION

Diagnostic Studies

Work continued on a Southern Tablelands study investigating the effects of different fertilizers on soil pH, aluminium concentrations and the growth of lucerne, subterranean clover and phalaris. Results show that if superphosphate, which is necessary for good pasture growth, is applied without liming on certain acid sedimentary soils which cover a large part of the Gunning area, soil acidity increases and also the concentration of aluminium in the soil solution. The persistence of lucerne is reduced and the establishment and growth of subterranean clover pastures adversely affected.

Phosphorus

Plot studies: At Condobolin A.R.S. it has previously been shown that there is marked response to deep placement of superphosphate. Observations suggested that surface applied phosphate might be less available to plants because of surface dryness common in lower rainfall areas. In a further investigation surface watering produced a much increased response to top-dressed compared with deep-placed superphosphate, at least at the higher rates of fertilizer application, confirming to some degree that surface dryness is implicated.

Work conducted from Wollongbar A.R.C. on carpet grass pastures on five different soil types showed yield responses to superphosphate applied at 75 kg P/ha at three of the sites. The response was particularly marked when ammonium nitrate was also applied. Superphosphate decreased carpet grass and increased native grasses in the swards at these same three sites and in general tended to increase the amount of paspalum particularly in the presence of nitrogen fertilizer.

Phosphorus test: Research continued at a number of centres with the object of developing a reliable soil test on which to base superphosphate requirements of pastures. Progress has been dependent on soil type and climate. On the granite soils at Shannon Vale Nutrition Station responses to phosphate have been consistent, and superphosphate needs predictable, but on the nearby black basaltic soils at Glen Innes A.R.S. relatively heavy dressings of superphosphate have increased the soil test levels very little. The capacity of this soil to fix large amounts of phosphorus has led to closer study of its clay mineralogy. Continued difficulty on the South Coast is also due to heavy phosphate fixation, less dependent on soil type than on the seasonal occurrence of intensely wet periods.

Nitrogen

On the South Coast, 135 kg N/ha applied to kikuyu grass in autumn increased production by 50 per cent and resulted in crude protein levels of 17.8 per cent after 12 weeks, reducing the decline which in untreated pastures resulted in levels of only 12.0 per cent. Digestibility remained over 70 per cent irrespective of delay in harvesting or nitrogen treatment.

In summer 135 kg N/ha increased production by 46.0 per cent but both crude protein and digestibility fell rapidly with time. Total nitrogen rate had very little effect in arresting the decline in quality. However, both crude protein level and proportion of leaf to stem were increased if a proportion of the total nitrogen dressing was withheld and applied 8–13 days before harvesting. An average reduction of 10 per cent dry matter occurred as a result of using this technique.

Potassium

Potassium run down has been studied in association with phosphate research at a number of centres. Potassium deficiency developed quickly on all the main agricultural soils of the South Coast under cut-and-remove pasture management, resulting in depressed pasture production, the elimination of clover and a reduced stand of the more valuable pasture grasses. In a plot experiment imposed on the beef production grazing trial at Grafton A.R.S. responses to potash were marked both in increased pasture production and legume content.

Lime

In work on kikuyu pastures at Wollongbar A.R.C. heavy applications of sulphate of ammonia (672 kg N/ha/annum) for 2 years decreased soil pH from 4.4 to 4.0, increased the soluble aluminium to a level considered to be toxic to plant growth and decreased the concentration of molybdenum, phosphorus and calcium. Liming in conjunction with sulphate of ammonia use resulted in a marked increase in production. Concurrent pot trials showed that lime increased kikuyu grass tops and roots at least twofold while gypsum had no effects on tops and increased only root growth indicating that the main effect of liming is not in supplying calcium but in its effect on pH and associated factors.

In South Coast trials, increased pasture production obtained on acid sites of pH 5.1 or 5.2 continued into the third year following application of lime at rates of 5 000 and 10 000 kg/ha. Liming also increased ryegrass at the expense of paspalum and increased the proportion of clover in the sward.

EVALUATION OF PASTURE SPECIES AND FORAGE CROPS

Native Pastures

North West survey: Production from native pastures is often low when compared with production from improved pastures. There are many reasons for such differences, but an extensive survey of the native pastures of the North Western Slopes of N.S.W. has shown that plant species play an important role. The wire grasses (*Aristida* spp.) dominate the native grass communities in many areas of the North Western Slopes, and being less palatable than the softer red, blue and wallaby grasses, they are becoming increasingly abundant. To evaluate the effect of phosphorus and sulphur fertilizers and the grazing animal on the species composition of native pastures, two grazing experiments have commenced in the Tamworth district.

Native legumes: A further aspect of native pastures has been investigated at Grafton A.R.S.. A large number of native legume species, including 86 *Glycine* spp., have been collected and grown in nursery plots. Many of the species are showing their superiority over the best introduced species in such attributes as cold tolerance and growth under adverse seasonal conditions.

Grasses

Temperate grasses: *Phalaris tuberosa* is an adaptable grass, and although the commercial cultivar has been sown widely in N.S.W., other cultivars are being evaluated for specific environments at Leeton, Berry, Cowra, Condobolin and Tamworth. At Leeton A.R.S., the yield of Sirocco phalaris was superior to those of other cultivars, under irrigation conditions. The ability of the hybrid phalaris Siro 1146 (*P. tuberosa* x *P. arundinacea*) to support a moderate level of dairy production in very dry seasons at Berry is in contrast with low production from perennial ryegrass (*Lolium perenne* cv Kangaroo Valley). Siro 1146 was also the best cultivar of phalaris under irrigation at Trangie A.R.S.

Trials at Tamworth A.R.C. in 1972 indicated that the perennial ryegrass cultivars Ariki, Kangaroo Valley and Medea have low persistence in that environment. Both the commercial and Sirocco cultivars of phalaris persisted satisfactorily, but the best species was tall fescue (*Festuca arundinacea* cv Demeter).

Most temperate grasses, with the exception of one cultivar of cocksfoot (*Dactylis glomerata* cv Currie), have persisted well in winter dairy pastures at Berry. Of the ryegrasses, Grassland Ruanui and a mixture of Kangaroo Valley ecotypes have been most persistent.

At Trangie A.R.S., studies of the adaptability of cultivars of cocksfoot, ryegrass and phalaris to irrigation in cool seasons and dry spells in hot summers have shown that Wimmera ryegrass (*Lolium rigidum*) and a late ecotype of Kangaroo Valley ryegrass regenerated or perennialized best after the first summer.

Tropical and subtropical grasses: A number of grasses suitable for beef cattle pastures on the North Coast are being evaluated at Grafton. In one experiment, couch grass (*Cynodon dactylon* P6936) produced more forage than pangola grass (*Digitaria decumbens*) and both were superior to two seeding cultivars of kikuyu grass (*Pennisetum clandestinum* cv Whittet and Breakwell).

The new cultivar of kikuyu grass, cv Breakwell, as well as *Lepedeza striata* cv Kaloe and *Aeschynomene falcata* cv Bargoo which have all been selected at Grafton A.R.S. were registered and released in 1972.

Legumes

Lucerne: The effect of rapid defoliation on the regrowth of lucerne was studied in the glasshouse at Tamworth A.R.S. Where the plants were defoliated over a period of 14 days, forage yields were as much as 50 per cent below those that had been immediately and completely defoliated. The slow defoliation treatment resulted in reduced root weights, slower shoot growth rate and smaller leaf areas.

Sowing an annual or perennial grass with lucerne has often been spoken of as a means of reducing the fluctuating forage production from lucerne pastures and, possibly, mitigating the risk of bloat in cattle. Experiments at Condobolin and Tamworth, where Sirocco phalaris was sown in swards with Hunter River and Paravivo lucerne, have pointed to the poor persistence of the grass – in many cases, Sirocco was virtually eliminated from the lucerne swards within 12 months. A severe reduction in the density of ryegrass (cv Medea) sown with lucerne has also been found at Tamworth A.R.S.

Annual medics: An expanded programme of testing selected introductions of annual legumes has commenced at Narrabri, Condobolin and Tamworth in an effort to find winter growing legumes which are adapted to these difficult environments but do not produce burrs which cause high vegetable fault in wool. At Condobolin A.R.S., the merit of annual medics compared with other annual legumes was confirmed. *Medicago truncatula* CPI 40729 has consistently ranked in the top three lines in forage and seed pod production and thus appears to be a much more adaptable plant than other lines. The seed pod of CPI 40729 is palatable and appears to make a negligible contribution to vegetable fault.

In a year of low rainfall at Narrabri A.R.S., *M. truncatula* CPI 40729 and three accessions of *M. aculeata* were more productive than the naturalized *M. polymorpha*. The commercial cultivars of *M. truncatula* (Jemalong, Cyprus and Cyfield) were inferior to some unreleased material and indicates the need for new cultivars for the heavy soils of the North West Plains.

Subterranean clover: Comparative agronomic experiments at Wagga A.R.I. and Tamworth A.R.C. have shown the superiority of new cultivars of subterranean clover. Those which showed promise at Wagga included Daliak and Midland B. At Tamworth, Daliak and Seaton Park produced more forage than Woogenellup, had better burr burial and produced more seed. Woogenellup had a large seed loss during summer and, consequently, produced fewer seedlings in autumn than Daliak and Seaton Park.

White clover: The ecotype, Kenya, was superior to two Mediterranean ecotypes, Haifa and Tamar, and commercial cultivars including Ladino and Grassland Huia, in several trials in the Grafton district. In cooler environments at Maitland and Berry, Kenya has not been as productive. The superiority of Haifa and Tamar over Ladino, Grassland Huia and Louisiana, has been demonstrated on shallow soils near Maitland. At Berry, the growth of Tamar and Haifa during winter has been outstanding, contrasting with the very low production of the commercial cultivars in that environment.

Red clover: Commercial cultivars of red clover have low winter production, poor persistence and high levels of plant oestrogens, which often lower the reproductive rate of breeding stock. In the first year of an evaluation of new cultivars at Berry, the winter yields of Quinequeli, and two naturalized lines, Boomer and Gartmore, produced ten times more forage during winter than the commercial cultivars, Montgomery and Cowgrass. Although the oestrogen content of the new cultivar, Redwest, was markedly lower than that of all other cultivars, its productivity was only half that of the three highest yielding cultivars.

Joint vetch: In trials at Grafton A.R.S., joint vetch (*Aeschynomene falcata* cv Bargoo) improved the quality of native and naturalized pasture during autumn and winter. This summer-growing legume produces forage of high quality, withstands dry conditions, and persists during autumn when pastures are dry and frosted. Joint vetch contains at least 10 per cent crude protein in autumn, when the pasture grasses contain less than 5 per cent.

Forage Crops

Forage oats: Trials at Wollongbar A.R.C. and Berry have confirmed that Saia is the best cultivar of oats for winter forage on the coast. Saia, sown into a prepared seedbed in early autumn at Berry, establishes quickly and provides good grazing within 6 weeks – ryegrasses sown at the same time take about 12 weeks to produce as much forage as oats, but yield more than oats during winter. Under some conditions, oats sod-sown into chemically treated paspalum pasture produced as much forage as sowings in prepared seedbeds.

Vetch: *Vicia dasycarpa* cv Namoi, a self-regenerating annual winter legume, is a promising alternative to forage oats in the Richmond and Clarence River areas, and subterranean clover (cv Clare) sown early (March) at high rates could be used in place of oats in the Manning River Valley.

WEEDS OF PASTURE

Nodding Thistle

A survey showed that nodding thistle, *Carduus nutans*, is widespread and a potentially serious weed on the Northern Tablelands. A dormancy mechanism restricts its annual germination but ensures a seed bank for long-term reinfestation. Herbicides can greatly reduce plant density but long-term control may depend on perennial grass pastures and light grazing during thistle germination.

Galvanized Burr

Ecological studies on galvanized burr, *Bassia burchii*, showed that its seedlings grow slower than medic seedlings but are more tolerant to heavy defoliation. However, density of adult burr plants in a lucerne stand was not reduced by grazing unless sheep were retained after all lucerne was consumed.

St John's Wort

Preliminary results in the control of St John's Wort, *Hypericum perforatum*, on non-arable land in the Central Tablelands show that surface-sown subterranean clover can establish amongst the weed without herbicide treatment but perennial grasses cannot.

Serrated Tussock

Poor kills of serrated tussock, *Nassella trichotoma*, by 2,2-DPA in the Central Tablelands in 1971 and 1972 were assessed to be due to unseasonably cool summers.

Bracken Fern

Asulum proved inefficient in killing bracken fern, *Pteridium esculentum*, on the North Coast when applied in December; results from an autumn application are being assessed.

INSECT PESTS OF PASTURES AND FORAGE CROPS

Amnemus Weevil

Amnemus quadrituberculatus is a pest of temperate and tropical pasture legume species on the Far North Coast. Ecological and biological studies of the insect were continued. They showed that female weevils commenced to lay eggs 12–30 days after emergence from the soil and continued for up to 170 days, with an average egg production of 1,240 per female in laboratory tests. Egg fertility was variable but averaged 73 per cent. Recapture sampling was used to study patterns of adult emergence and behaviour in the field.

Presowing soil treatment with dieldrin and heptachlor at 1.12 kg/ha active ingredient has given good *Amnemus* control for the first 5 years of the pasture, in one trial. In another trial, rates of 0.56 and 1.12 kg/ha of heptachlor and 1.12 kg/ha of dieldrin still gave significant control after 3 years. However, legume decline occurred in all experiments, despite weevil control, so that *amnemus* attack is probably only one factor in the failure of legume sowings.

Plague Locust (Chortoicetes terminifera)

Locust swarms invaded N.S.W. from Queensland in late summer, eventually extending into Victoria in autumn during a subsequent locust generation. By late May, 1973, most of western N.S.W. was infested and widespread egg laying had occurred. Field studies indicated that long-range displacement of locusts took place at night, distances travelled being 300–500 km. Such movements were correlated with recognizable synoptic weather patterns. Fixed-wing aircraft were found effective for surveying remote areas and observing dense, hopping bands of locusts.

Toxicological studies involving topical application of chemicals to laboratory-reared locusts showed that fenitrothion was four times as toxic as maldison.

Wingless Grasshopper

Dense populations of *Phaulacridium vittatum* caused severe damage to improved pastures and forage crops in tablelands areas from November, 1972, to January, 1973, during a period of moisture stress.

Laboratory bioassay of field-collected grasshoppers showed that fenitrothion was twice as toxic as the recommended dimethoate and fenthion and four times as toxic as maldison.

Noctuid Caterpillars

Native budworm (*Heliothis punctigera*) and cluster caterpillar (*Spodoptera litura*) were successfully reared on a semisynthetic, lima bean-based diet. Bioassay screening of twelve insecticides was carried out

against late instars. Bioresmethin, Dursban and endosulfan were at least as toxic as the recommended material DDT against native budworm while methomyl, Dursban and endosulfan showed promise against cluster caterpillar. The screening project is continuing.

PASTURES DISEASES

Root Rot of Lucerne

Current research aims to select a variety better suited to wet soil conditions. Glasshouse experiments at Rydalmere have shown that Lahontan and Siro Peruvian possess tolerance to root-rot and selections from these cultivars is being made in co-operation with a CSIRO plant breeder.

Yellows of Lucerne

The widespread "yellows" condition of lucerne has been transmitted in the glasshouse by grafting diseased stem tips onto healthy plants, thus proving that this disease is caused by a biological agent.

Virus Diseases of Pasture Legumes

Research on virus occurrence in pastures showed that subterranean clover red leaf virus caused considerable damage at Taree while rugose leaf curl was common in white clover pastures throughout the State.

Root Rot of Subterranean Clover

Examination of a range of soil types has shown that *Pythium irregulare*, the principal cause of root-rot, occurs at high population levels only in soils that have received high total applications of superphosphate.

Methods of reducing the effects of root-rot by soil and seed treatments are being tested in a field trial at Goulburn while a search for resistance amongst available cultivars continues at the B.C.R.I., Rydalmere.

Kikuyu Yellows

A biological agent present in diseased plant parts and in soil from affected patches is now recognized as the cause of this disease and symptoms can be reproduced in glasshouse tests. A wide range of fungi has been isolated from diseased roots and *Gaeumannomyces graminis* var *graminis* is the most common.

GRAZING AND PASTURE MANAGEMENT

Sheep

Natural pasture: In conjunction with a botanical survey of natural pastures on the North West Slopes, experiments at selected sites have been initiated from Tamworth A.R.C. to determine the grazing production with both sheep and cattle from these natural pastures at a range of stocking, phosphorus and sulphur rates. Animal responses to both stocking rate and phosphorus have already occurred. However, the response to phosphorus has been transient and governed by seasonal conditions.

Due to the seasonality of herbage growth by natural pastures, feed supplementation is often required. At Trangie A.R.S. the role of grazing lucerne as a supplement to annual natural pastures and perennial natural pastures has been under investigation. Due to adverse seasonal conditions which affected both the natural pastures and lucerne, supplementation with lucerne pasture did not improve ewe condition or lamb growth rate. Lamb mortality was high in all treatments.

In many years barley grass, due to its prolific seed production, causes severe problems to lambs during spring. Research at Trangie A.R.S. has shown that higher stocking rates and deferment of grazing until the barley grass reaches the multileaf stage tend to reduce barley grass density in the subsequent spring.

Improved pasture: At Glen Innes three rates of superphosphate per annum — nil, 250 and 800 kg/ha — and two stocking rates — 7.8 and 15.6 wethers/ha — are being compared in a factorial grazing trial commenced in 1968. During 1973 higher wool production was obtained from pastures receiving the heaviest dressing of superphosphate and stocked at the higher rate. The results probably reflect better clover performance resulting from the treatments.

At Cowra A.R.S. the grazing management of lucerne, sub. clover/ryegrass pastures is being studied. Production from crossbred ewes is being monitored under set stocking, rotational grazing and deferred grazing conditions. Lamb growth rates were superior when set stocked and it is suggested that rotational grazing is less efficient in converting feed to liveweight in growing lambs.

To determine economic means of improving the "year-round" feed supply available to breeding ewes in the southwest wheat belt a range of different pasture types have been examined at Temora A.R.S. Ewe performance, both in terms of liveweight and wool production, was superior on lucerne based pastures.

A response in animal production to grazing oat supplementation, particularly when used in association with subterranean clover pastures was recorded during the past year. This response had a long-term effect on ewe liveweight.

In an investigation of the ley farming system at Wagga A.R.I., a central objective in the cropping phase is to study the carry-over effects of stocking rates and top-dressing rates from the pasture phase.

The value of a Jemalong barrel medic pasture, at Trangie A.R.S. as a ley component of a pasture crop rotation has been demonstrated. However, a dependance on favourable winter rainfall governs herbage growth and consequently animal performance.

Lucerne: Animal performance on lucerne pastures has continued to receive a great deal of attention at Wagga, Condobolin, and Tamworth, as well as the studies mentioned previously where lucerne is used as a supplement or as a component of a mixed pasture.

Merino ewes grazing lucerne and volunteer annuals at Wagga A.R.I. were compared under two different systems of grazing management (nine-paddocks and three-paddocks). Lucerne declined more rapidly in the three-paddock system. However, although influenced by stocking rate, ewe liveweights and wool production were not affected by management system. Lamb growth rates were superior on the three-paddock system. These results suggest that for lucerne survival more than three-paddocks are needed on the rotation. However, the nine-paddock system had similar wool production but lower lamb growth rate. A compromise has been achieved in another experiment at Wagga where a four-paddock system was employed. Lucerne survival and animal performance were very satisfactory under this management strategy.

Research into the place of lucerne-based pastures has been expanded during the past year to study the integration of these pastures and forage crops (winter cereals) in the various rainfall zones of the Southern Slopes.

At Condobolin A.R.S. the hypothesis is that animal and plant responses to superphosphate are low or even non-existent until high levels in the soil are attained. Responses supporting this hypothesis were more evident in 1972 than in 1970 or 1971 despite the dry winter and spring conditions. By 1972 these treatments had received 1 000 kg per ha of superphosphate. Continued dry conditions and death of the lucerne plants resulted in this experiment being terminated in mid-December, 1972.

Irrigated pastures: For an autumn lambing situation it has been possible to carry 14.8 Border Leicester cross Merino ewes/ha on winter pasture (irrigated sub. clover—wimmera rye grass) at Leeton A.R.S., without depreciating wool and lamb production. The inclusion of small areas of summer pasture or sod sown oats did not increase production of wool and lamb sufficiently to be a commercial proposition.

Integration of crop and animal production: The contribution of crop stubble to the nutrition of sheep during summer is being evaluated from Canberra, as a co-operative programme with CSIRO Plant Industry. Results indicate that stubbles of wheat, oats and barley together with their weed and grass content should maintain liveweight of sheep for at least 11 weeks at a stocking rate of 15 sheep/ha. A significant response was also obtained to molasses, urea and urea plus molasses in sheep grazing weed free oat stubble. Urea supplementation significantly influenced liveweight gain of sheep grazing weedy stubble.

Beef Cattle

Improved pastures — Clarence River: Grazing Hereford steers have been used at Grafton A.R.S. to establish the optimum maintenance rate of superphosphate fertilizer (treatment range from 0 to 500 kg/ha per year) for pastures sown with naturalized white clover on shale soils which received 1 500 kg superphosphate/ha in the previous four years. Previous experiments have shown that beef production could be doubled when clover was sown on these soils and fertilized. Results to date indicate no effect of superphosphate rate on liveweight of steers at either 1.6 or 2.5 steers/ha. Pilot trials suggest that the pasture growth on the heavily fertilized plots may be restricted by low available soil potassium.

Hereford heifers have been allocated to pastures sown on sandstone soils at Fineflower, near Grafton. No data on beef production are available but after twelve months there was a marked increase in white clover and paspalum. This followed cultivation, sowing and fertilizer application to a pasture which had previously been dominated by native grasses.

Improved pastures — Northern Tablelands: At Glen Innes A.R.S., results again indicated that breeding cows required considerable supplementary hay feeding, during July and August, at stocking rates above 0.84 cows/ha on improved pastures (*Phalaris tuberosa* and *Trifolium repens*).

This problem of poor winter production has led to an evaluation of grazing oats as a means of supplementing weaner cattle. Weaners grazing pasture on Glen Innes A.R.S. with free access to grazing oats had higher liveweights and sale price than those grazing pasture alone or other management systems on the grazing oats. However, it appears that the sale price is not improved enough to achieve economic justification of the system.

Dairy Cattle

Grazing pressure on kikuyu pasture: The effect of different levels of availability of kikuyu pasture on production and liveweight change of dairy cows is being studied in an experiment at Wollongbar A.R.C. Grazing pressures being used in this study vary from 350 to 1 700 kg DM (green leaf) ha⁻¹. Preliminary results indicate a decrease in butterfat production and greater liveweight loss in cows being grazed at the high grazing pressures. Further studies are planned.

ECONOMICS – PASTURES

Evaluation of Returns to Pasture Research

An economic model was developed for evaluating the benefits to Australia from pasture research. The estimates suggest that the rate of return on investment of public funds in pasture research in the post-war period probably has been very high. The important pasture research findings were predominantly in the field of plant nutrition.

The study suggested that adoption lags to new pasture technology and farmer response to changes in the price of fertilizer were very short.

LIVESTOCK AND LIVESTOCK PRODUCTS

SHEEP AND WOOL

Feeding and Nutrition

Drought feeding: Diets consisting of up to 80 per cent wheat were fed three times weekly to pregnant and lactating ewes at Trangie A.R.S. to determine the most economical diet for hand feeding breeding ewes. Milk production was measured on all ewes as the lambs reached 14 days of age and production rates were as high as expected from pasture fed ewes.

Production feeding: The feeding of sheep for production is being investigated at Trangie A.R.S. When 0.5 – 1.0 per cent formaldehyde was added to cottonseed meal and fed at 169 g/head/day, the wool growth of Merino sheep fed these diets increased by 9 and 3 per cent respectively. Wool growth was depressed when sheep consumed cottonseed meal treated with 2 per cent formaldehyde.

At the Glenfield Drought Nutrition Unit a series of experiments is being conducted to evaluate diets and management techniques for feeding sheep, particularly weaner lambs, for production. This would obviate the effect of seasonal conditions on meat supply.

When introducing high grain sorghum based diets to weaner lambs over an 8-day period, a high loss of liveweight occurs. It was subsequently shown that neither length of introductory period (1 – 5 weeks) nor final ration composition (concentrate:roughage of 90:10 or 70:30) affected lamb growth rates or carcass grading.

In other experiments:

- The optimum ratio for oats/roughage (hammermilled lucerne hay) for production in weaner lambs was established at 60/40 for lamb growth and food conversion.
- In feeding weaner lambs, the summer crops (maize and sorghum) were superior for production feeding followed by oats, wheat and barley. With the exception of maize there was no advantage in rolling the grain.
- Lamb growth rates, daily feed intakes and food conversion are significantly improved by sodium supplementation of diets.

Carcass Evaluation

Carcass characteristics and quality of sheep are being studied at Trangie A.R.S., to examine the effects of selection and management practices. The use of specific gravity for the estimation of carcass composition was tested but the degree of accuracy was not acceptable. Other results using the dissection technique indicate that age of the animal may explain the observed association between level of fatness and changes in muscle weight distribution.

Genetics and Breeding

Selection for production characters in Merino sheep: The 1972–3 results of the single character selection flocks (selected for and against fleece weight; weaning weight) maintained at Trangie A.R.S. conform with the established trends for these flocks. The asymmetric response in fleece weight was again evident with the Fleece Plus flock producing 17 per cent more clean wool than the Random flock and the Fleece Minus flock 37 per cent less.

Fertility flock: This flock developed at Trangie A.R.S. features high clean fleece weight, high growth rates and excellent lambing performance. In 1974, the Fertility flock will be incorporated into a larger flock presently being assembled on a broad genetic basis, in which selection for increased reproductive performance will be stressed together with increased fleece weight and other characters of economic importance.

Border Leicester breeding: At Cowra A.R.S. the Border Leicester flock is being studied to collect basic information on the genetic parameters applicable to this breed. The flock is now closed to outside introductions and the first progeny born within their respective selection flocks will be mated in 1974.

Slaughter and X-ray techniques have been utilized in a study of the incidence and magnitude of pneumonic infection in Border Leicester sheep obtained from different genetic sources. Significant differences were observed in the incidence of pneumonia in these flocks and it appears that the X-ray technique has considerable potential in detecting gross pneumonic infection in the live animal. The Condobolin BLI (Border Leicester Improved) strain combines high fertility and survival with freedom from pneumonia.

Dorset Horn breeding: Flocks of purebred Dorset Horn sheep are maintained at Cowra A.R.S. for the study of genetic parameters in this breed. After a number of generations, selection flocks should contain sheep which are genetically diverse and can be used for both physiological and efficiency studies.

From the study of dystocia in Dorset Horn ewes it would appear that forelimb length in the live animal and conjugate diameter (length of pelvic cavity — anterior process of the pubic symphysis to the junction of the sacrum and last lumbar vertebra) and pelvic area post-slaughter are associated with the problem. Predictive equations related to various skeletal measurements (forelimb length) are being developed that may aid selection against dystocia in the live animal.

Comparison of prime lamb mothers: In previous years at Glen Innes, Dorset Horn cross Merino ewes were found to be more productive than Border Leicester cross Merino ewes for lamb production in the autumn. However, wool quality in the Dorset Horn cross Merino was never satisfactory and it is hoped that the present utilization of fine wool Merino rams mated to the Dorset cross ewes may provide valuable data. The effect of this breeding programme on reproductive performance and growth of lamb progeny will also be assessed for both spring and autumn joining.

Efficiency of wool production: A series of studies is being undertaken at Trangie A.R.S. to investigate genetic and environmental factors which influence the efficiency of conversion of feed into wool. In an experiment designed to test whether the epidermis of the foetus and young lamb responded to absorbed sulphur amino-acids, cystine was administered to ewes at day 130 of pregnancy or to the lambs at birth. All wool measurements have not yet been completed, but the clean fleece weight of hoggets derived from cystine treated ewes was 3.02 kg while that from the controls weighed 2.66 kg — a difference of 14 per cent. There was no difference in fleece weight between the cystine treated lambs at birth and the controls. This study is continuing as the response to absorbed sulphur amino-acids may be a means of improving the animal's lifetime wool production.

Reproduction and Fertility

The ram: A study initiated from CSIRO, Prospect and conducted at Condobolin A.R.S. and Hawkesbury Agricultural College has clarified the economic importance for N.S.W. of high temperatures and flock reproductive performance. Radio telemetry, metrological and flock performance data now suggest that infertility among rams is a real but marginal problem and that mating flocks can sustain high levels of ram infertility without apparent harmful effects.

Management strategies with sheep: Traditionally, the joining period of sheep husbandry has been a simple exercise with little subsequent supervision. A study being conducted from CSIRO, Prospect is formulating recommendations on ram percentages, ram replacement strategies and the management of flock joining in order to achieve higher productivity.

Officers from Leeton A.R.S. in association with District Livestock Officers are assessing the lifetime productivity of single and twin born lambs on commercial properties. Though single born ewes have been initially heavier and cut more wool than twin born ewes, the difference at 18 months of age was negligible. Limited data suggests that the reproductive performance of twin born ewes was superior to that of single born ewes.

Pregnancy testing and identification of twin bearing ewes: In a co-operative study with the CSIRO, Prospect, the early identification of twin-bearing ewes has been attempted by estimating plasma progesterone levels. Results show that the predictive value is not high enough for routine field use.

The evaluation of a palpation technique for pregnancy and twin diagnosis in sheep is being conducted at Trangie and Glenfield. The technique involves palpation of the abdominal region of the ewe aided by a palpating rod inserted per rectum, while the ewe is restrained on its back.

Fertility studies in Border Leicester cross Merino ewes: Several conclusions have resulted from fertility studies on Border Leicester cross Merino ewes conducted at Leeton A.R.S. Failure of ewe impregnation by the ram has been demonstrated and may explain apparently inconsistent field results that have been previously reported. A simple technique of taking vaginal smears has been developed which shows great promise as a diagnostic technique to determine the proportion of flock mated ewes which are actually impregnated.

When maiden and mature Border Leicester cross Merino ewes are mated at the same liveweight then their fertility levels will be similar, though mature ewes may be expected to produce more twins. No consistently large effects of liveweight at joining or level of nutrition after joining on embryo survival have been demonstrated and it was concluded that these factors are unlikely to be of importance in the field.

Mathematical models: The development of a mathematical model of reproductive wastage in ewes and a further model to describe the relationship between behavioural, physiological and environmental factors limiting fertility in a paddock joining system, is being undertaken from CSIRO, Prospect.

Procedures have been developed for distinguishing between matrices describing embryonic survival in single and twin ovulating ewes. Further field experiments are being conducted to collect data on reproductive wastage.

Management

Sheep coat trials: 40,000 sheep were involved in field trials carried out by district livestock officers to determine the durability and retention of plastic sheep coats and to assess their value for wool protection. Loss of coats was excessively high due to inadequate coat design, unsuitable plastic material and problems related to coat size. The few coats that were retained indicated that some measure of wool protection was achieved producing increased wool yield with less vegetable fault.

Disease

Internal parasites: Two field trials examined the response of sheep to regular anthelmintic treatment with tetramisole. Ewes treated fortnightly showed higher body-weight, wool production and lambing percentage than did untreated control ewes. On the other hand, monthly treatment of Merino weaners failed to produce weight gains significantly different from other groups receiving tactical or emergency treatments.

An investigation of ill-thrift in weaner sheep on the Northern Tablelands indicated that nutrition and intestinal round worms were the principal causes. No role was demonstrated for tapeworms, coccidia or cobalt deficiency.

Sheep blowfly: Work at the Rydalmere B.C.R.I. has covered semifield and laboratory aspects of the problem of insecticide resistance and blowfly control. Results from larval implant trials suggest that registered organophosphorus (OP) insecticides will provide adequate protection providing sheep are thoroughly jetted just prior to fly waves. Butacarb, the only carbamate registered for blowfly control, was considerably less effective.

A survey to determine the distribution of insecticide-resistant strains of blowfly and their resistance levels showed resistance to carbamate and organophosphorus insecticides throughout the State, with levels of resistance being comparable to those observed over the past three fly seasons.

Because of a low incidence of fly activity during the year inconclusive results were obtained from the thirty field trials examining the protective value of currently used insecticides, and organized from the Glenfield V.R.S.

At Glenfield, preliminary observations have been made on an *in vitro* technique for assessing insecticides by treating and weathering shorn wool which is then exposed to larval inoculation at intervals after treatment. Results obtained have to be further compared with results of field trials.

Congenital disease in sheep: Previous work has demonstrated that a condition of lambs characterized by hairy birth coats and poor viability could be transmitted to the offspring of ewes inoculated during pregnancy. MD virus was recoverable from tissues of both original and transmission cases. Further transmission trials support the causative relationship between an MD virus and the disease.

This disease has been compared to Border Disease as described in the United Kingdom and to Hairy Shaker Disease as described in New Zealand. Tests of imported sera conducted at Glenfield V.R.S. have demonstrated that MD viruses are similarly implicated in these overseas diseases.

Economics

Outlook for wool: A number of factors suggest that future prices for wool may be less than those observed during 1972–3. Because of the high wool prices many processing mills have stated their intention, and indeed orders for, significantly greater use of competing synthetic fibres.

Farm management: Partial budgeting studies have investigated the financial benefits, costs and returns of lot feeding of lambs and the net worth of sheep to the individual farmer.

Budgeting and regression procedures were employed to isolate the most important factors involved when deciding on the time of lambing. These factors were the price of lamb, the lambing percentage and the stocking rate.

Financial situation of Cobar landholders: A stratified sample survey was used to evaluate the economic condition of landholders in the Cobar area over the period 1967–8 to 1970–1. Estimated average annual net farm income of \$2,347 and average percentage return to capital and management of –0.88 per cent indicate the low income status of Cobar landholders during this period. It is presumed that this situation will have greatly improved following the subsequent rise in wool prices.

Drought feeding: A linear programming model was used to determine least cost feed rations for drought feeding of sheep. The least cost feed mix contained pollard, limestone, salt and sulphur. This ration was found to be optimal over an extensive range of price assumptions. The addition of minerals to the ration introduced substantial cost savings relative to the more commonly used all wheat ration. Trials at the Glenfield D.R.U. indicate that the least cost ration is satisfactory in a technical sense.

BEEF CATTLE

Nutrition

Supplementary feeding: The effect of supplements containing phosphorus, molasses-urea-phosphorus or linseed meal-phosphorus on the liveweight of grazing cows and calves is being studied at Grafton A.R.S. Cattle graze carpet grass (*Axonopus affinus*) pastures, which are low in crude protein and phosphorus during winter. Supplements are given in high troughs to prevent access to calves. There was no significant effect of the supplements upon cow liveweights or pregnancy rates in 1972. However, calves from cows on the phosphorus supplement were significantly lighter (144 kg) than those from cows on linseed meal-phosphorus supplements (158 kg).

In pen studies at Grafton A.R.S., urea (50 g/day) infused directly into the rumen of cattle, eating a matured carpet grass hay, increased the digestible organic matter intake (DOMI). The DOMI by cattle from the pasture was not increased by higher infusion rates of urea or by the addition of molasses. High infusion rates of urea (100 g/day) tended to reduce pasture organic matter digestibility.

Feedlot studies: At Trangie A.R.S. the growth rate and meat quality (tenderness) of cattle given *ad libitum* and restricted feed lot rations are being compared to similar cattle grazing irrigated pastures.

Joint vetch: The nutritive value of a newly selected legume (*Aeschynomene falcata*) for ruminants is being determined at Grafton. The preliminary study (with sheep) indicated that the legume contained no toxic factors nor did it deleteriously taint the carcass meat. It was suggested that the legume would improve the apparent digestibility of phosphorus and crude protein in pastures growing on the dry sandstone soils of the North Coast.

Breeding

Selection on measured performance: A comparison of genetic progress made from selection on liveweight to that from visual selection based on type is being made in herds at Trangie A.R.S. Data for 1971 indicated that visual selection of bulls and heifers was correlated with 12-month liveweight ($r = 0.63$). The top group of visually selected bulls were closely related to a liveweight selection.

Crossbreeding: At Grafton A.R.S. a long-term crossbreeding experiment has started. F_1 female production from Brahman, Friesian and Simmental sires will be compared with female cattle from Hereford sires, over the Grafton Hereford herd. Cows were artificially inseminated and calving commenced in July, 1973.

Correction factors in beef recording: Computerized data from beef herds in N.S.W. are being used to assess the validity of currently recommended and used correction factors, which are applied in beef cattle selection programmes. The technique indicates that standard correction factors may not apply to Angus herds nor be adequate for other breeds.

Physiology

Five trials were started within N.S.W. to study the physiological and endocrinological effects of prostaglandin $F_{2\alpha}$ and prostaglandin analogues, which are used to synchronize oestrus in cattle. Either subcutaneous or intramuscular injections of the prostaglandins gave consistent synchronization without noticeable side-effects, although the cost was high.

Research Techniques

Measurement of intake: A technique, based on tritiated water labelling, is being assessed for estimating a supplement intake by cattle. This work is co-operative with the University of New England. Techniques for estimating pasture intake and digestibility for use in field studies at Grafton A.R.S. and Glen Innes A.R.S. were examined and modified during the year.

Economics

Beef production in dairying areas: A survey was made of specialist beef producers located in four traditional dairying shires to investigate the economics of alternative forms of beef production in these areas. Because specialist beef production was a relatively new activity, efforts to obtain detailed financial information were largely unsuccessful. It would appear that the bulk of beef production in the four survey shires, and perhaps former dairying areas generally, is conducted on holdings which provide only part-time employment.

The technical and economic feasibility of rearing surplus bobby calves produced from dairy herds was investigated. It was found that significant financial gains may be obtained by rearing surplus bobby calves using several alternative systems.

Wholesale and retail margins for meat: Updated estimates of the auction prices, the wholesale prices and the retail prices for beef, mutton and lamb were prepared. These price estimates were used to derive estimates of the per kilogram gross returns or margins to wholesalers and retailers of red meats. The estimated margins indicate that both wholesalers and retailers essentially employ a constant per kilogram price increase in determining wholesale and retail prices. Also, changes in auction prices are reflected in wholesale and retail prices, although in some cases there may be a lag of 1 or 2 months.

Cost-benefit study of cattle tick control vs eradication: A cost-benefit study is being undertaken to assess the private and public costs of continuation of the present policy of tick control in N.S.W. in relation to an eradication program involving intensified control in the short term leading to a reduction of control measures and costs in the long term.

Econometric model of N.S.W. cattle and sheep sector: Econometric procedures were used to construct a model describing the average annual farm prices and the annual supplies of beef, lamb, mutton and wool, and the 31st March inventory of beef cows, dairy cows, steers, sheep and ewes mated to British breed rams. Prices of the meats are largely determined by export prices and quantities of the meats supplied. Annual quantities of livestock products supplied can be explained by the opening inventory of livestock, relative livestock prices and seasonal conditions. Closing inventory levels of livestock can be explained by relative livestock prices, seasonal conditions and the area of improved pastures. Considerable time lags in inventory and particularly supply response to an increase in prices were observed.

The estimated model has been used to forecast future slaughter levels and to evaluate policy changes such as a tax or subsidy on meat exports.

United States beef imports: A growing import demand for manufacturing type beef and also high quality feedlot type beef by the U.S.A. is projected for the next 5 years. The slow growth rate of the number of beef cows in the U.S.A., the declining number of dairy cows and the dominance of feedlotting of cattle is expected to hold U.S. production of manufacturing beef to about current levels, with consequent likelihood that import restrictions on beef will not be re-introduced for some time.

DAIRY CATTLE

Supplementary Feeding

Forage oats supplementation: The response by dairy cows to a supplement of forage oats is being investigated at Wollongbar A.R.C. In a completed experiment, cows grazing kikuyu grass pastures were fed at four supplementation levels. A milk production response to 2 kg oats was obtained but this response declined with higher levels of supplementation. Currently, another experiment is being conducted to more clearly define the response to forage oats.

Energy and mineral supplementation: This experiment is being conducted at Wollongbar A.R.C. and is designed to evaluate the response by cows to crushed grain and mineral (sodium + calcium + phosphorus) supplements. Cows are being fed the mineral mix *ad lib* and either 0, 2, 5 or 8 kg crushed grain/day. In two other treatments cows do not receive the mineral mix but are fed daily either 0 or 8 kg crushed grain. This experiment is nearing completion but it is too early to present results at this stage.

Breeding

N.S.W. Dairy Herd Improvement Programme: This is a statewide programme designed to increase the production efficiency of dairy herds in N.S.W. through selective breeding. The first group of "elite" cows has been selected from the State's population and owners are being contracted to produce young bulls from these cows for use in the programme. Improvements in data handling and the possibility of central testing for fat and protein are two factors likely to improve efficiency. Furthermore, an extensive statistical analysis presently being conducted will provide better methods of estimating the breeding worth of animals.

Calf Nutrition

Dairy beef production: The rearing of crossbred calves by multiple suckling is being evaluated at Wollongbar A.R.C. as a supplementary enterprise for the dairy farmer. A system of dairy beef production entailing the suckling of two or three calves for the first 9 to 10 weeks of lactation has now been evolved and has been presented to farmers at a number of field-days. Following the suckling period nurse cows produced more milk than cows which had been milked during early lactation. This extra milk production obtained during the post-weaning period helps offset the milk lost during the suckling period, resulting in lower rearing costs.

Post-weaning growth rate of calves: Previous studies at Wollongbar A.R.C. have shown that nitrogen fertilized kikuyu grass will only support lower liveweight gains in calves than those recorded on temperate pastures. An experiment is therefore being undertaken to determine if growth rates on kikuyu can be improved by energy and/or mineral supplementation. Calves are being fed 0, 0.9 or 1.8 kg crushed maize/day with (*ad lib*) or without a mineral supplement containing sodium, calcium and phosphorus. Considerable responses to 0.9 kg maize and the mineral supplement have been recorded to date, with a lesser response to 1.8 kg maize.

Intensification of vealer production by multiple suckling: These studies are being undertaken to determine if beef production in a vealer enterprise can be increased by use of multiple suckling once advantage has been taken of pasture improvement. Such a technique could be used on the dairyfarm as a supplementary enterprise, or as a means of intensifying vealer production on specialist beef properties. In the present study Guernsey cows are suckling two or three calves and are being grazed on nitrogen fertilized tropical grass pasture at a range of stocking rates. Preliminary results indicate that satisfactory vealers may be produced at two calves/cow at lower stocking rates. Further studies are planned.

Economics

Feed year programmes for North Coast: Further work on the likely implications of developments of pasture technology in the North Coast area using a linear programming model has explored the sensitivity of optimum farm organization and profits to variations in farm resources, input costs, product prices and assumptions about the relative productivity of feed year species. Variable resources programming indicated the sensitivity of feed year plans to assumptions about farm size and the availability of labour.

The importance of temperate pasture and forage crop species to fill the winter feed gap was highlighted. The application of nitrogen to kikuyu pasture was also a feature of all plans.

Dairy Herd Recording Scheme: An input demand model was used to determine the demand function for herd recording by farmers and to measure the economic surplus or benefit accruing to society from pricing the dairy herd recording service at less than cost.

DAIRY PRODUCTS

Milking Machines

Standards of performance: Work continues at the Richmond Dairy Research Centre on the development of standards of performance for milking machine components. An improved device has been built and is under development for testing of milking machine teat cup liners while new components are being tested against published standards for vacuum regulators and end-of-milking indicators.

Testing machines: A manual on the testing of milking machines has been drafted. This will be used as a curriculum for machine testing schools and will be distributed to field officers.

Dairy Hygiene

Commonwealth Advisory Laboratory: The Commonwealth Advisory Laboratory on Dairy Detergents and Sanitizers (C.A.L.) was established in 1971 at the Richmond D.R.C. to advise the dairy industry on the performance of the detergents and sanitizers used to clean equipment.

The Standards Association of Australia (S.A.A.) has published two new standards on dairy detergents and sanitizers. These have allowed the laboratory to test an increased number of products. Bulletins containing the results of these tests are distributed to all sections of the Australian dairy industry.

In N.S.W., the Dairy Detergent Advisory Scheme has been established as a means of supplying samples to the C.A.L. for evaluation and also to promote the results of testing throughout the dairy industry of the State. Testing of "off-the-shelf" samples has commenced to allow the quality of market samples to be assessed.

Another function of the C.A.L. is to develop new techniques for the evaluation of dairy detergents and sanitizers. The development of a glass slide test for evaluating the cleaning efficiency of general purpose dairy detergents was finalized and submitted to the S.A.A. A specification for sanitizers not covered by existing standards has also been submitted. A large amount of laboratory development work will be required before this specification can be published.

The C.A.L. has also undertaken research into the public health implications of dairy detergent and sanitizer residues. Work is continuing on the sanitizer content of milk and dairy products and methods of reducing this to an acceptable level.

Bulk tank cleaning: The development towards bulk handling of milk both on the farm and in the factory has created a demand for improved cleaning techniques. In a project to develop these techniques new apparatus is being used to assess the cleaning effect of impinging solutions. A bulk tank cleaning simulator, which will allow assessment of methods of cleaning of all types of bulk receiving vessels both farm and factory, is nearing completion. A field trial comparing currently available methods of cleaning farm refrigerated tanks is in progress.

Measuring factory hygiene: To complement improved cleaning techniques, there must be effective quality control. There is a need for a test which examines the hygienic quality of dairy factory equipment and produces a result in less than one day. Research has shown that an accelerated and convenient dye reduction test appears to be an encouraging possibility.

Quality of Manufactured Products

Copper: Copper determinations were undertaken at the Richmond D.R.C. to complement factory investigations of butter defects. Many milk samples from which the butter was made were found to have a high copper content indicating faulty farm equipment. Several butter samples also had copper levels high enough to catalyse oxidative degradation.

Butter quality and storage: At Wollongbar A.R.C. investigations were undertaken to assess the effect of different storage temperatures on microbial growth in continuously made butter. The results showed that bacterial growth does not occur in salted uncontaminated butter even at favourable temperatures, although fungal growth can occur.

The evaluation of the "Bactostrip" as a quality control measure in butter manufacture was continued at Wollongbar A.R.C. A modification to the technique was developed eliminating the necessity for two pieces of equipment and one tedious step.

Yeast and mould growth is still an important cause of defects in butter. A new medium for the determination of yeasts and moulds was developed which showed considerable benefits over the medium formerly used.

The Development of New Dairy Foods

The aim of this project is to develop new dairy foods, in co-operation with dairy companies, in order to increase the profitable utilization of milk.

Custards, spreads, cheeses, beverages: One research project at Richmond D.R.C. has culminated in the successful commercial launching of a prepared dairy custard in Sydney. Two milk-based spreads are currently being developed with the co-operation of two companies while initial work has begun into the production of a type of soft cheese. Several trials have been conducted to assess the feasibility of using hard milk fat fraction in cheddar cheese. Development work on a milk-fruit juice beverage is now in the concluding stages and the company co-operating in this project hopes to launch this product early in the coming financial year.

Sausage emulsions: Sausages have been made in which half of the meat protein is replaced by milk protein and work is continuing to produce an acceptable meatless sausage for export to countries where meat is scarce or expensive. Fundamental research is being conducted on emulsions. This work will provide useful information in the development of new dairy based foods.

DISEASES OF CATTLE

Cattle Tick Ecology

Larval survival: Studies were commenced at the Wollongbar Cattle Tick Research Station in September, 1970, and at Tabulam in September, 1971. Data from larval exposures showed that 95 per cent of larvae died within 7 weeks at Wollongbar and 5 weeks at Tabulam between September and January. As monthly mean air temperatures and rainfall differed little between areas the greater die-off rate at Tabulam was probably related to short periods when climate was extreme. For March to August, 1972 the corresponding figures were 9 and 5 weeks. Autumn/winter rainfall was considerably less at Tabulam (37 mm) than at Wollongbar (198 mm).

These results show that pasture spelling could be a feasible method of tick control at Tabulam where paddocks need only be left vacant for 5 weeks anytime during the year.

Field studies of tick generations: In one year's observation at Wollongbar C.T.R.S. commencing in November, 1971, the 4th generation of ticks was counted on the sampling herd between August and October, 1972. A 500-fold decline in population from the 3rd to the 4th generation occurred and demonstrated the remarkable degree to which winter controlled large autumn populations.

A repeat study showed that the greater than expected spread of generations last year was not caused by an extended emergence span of larvae due to differential rates of hatchings on a multislope paddock. However there was a greater increase this year (forty-seven as opposed to ten-fold) from the first to the second generation and a lesser increase (ten as opposed to thirty-two-fold) to the 3rd.

Host resistance: The resistance levels (percentage of ticks rejected by the host) were assessed for different breeds of cattle which were previously infested as 99.5 per cent (highly resistant) for a herd of Jersey-Guernsey cows, 97.0 per cent (moderately resistant) for their crossbred Hereford offspring and 91.4 per cent (susceptible) for a herd of Hereford heifers.

Acaricide Application for Cattle Tick Control

Evaluation of candidate acaricides: The Wollongbar C.T.R.S. and the Lismore Board of Tick Control Laboratory collaborated to study Chlorphenamidine by itself and in a mixture with Ethion, both buffered with triple superphosphate. At a concentration of 0.1 per cent in a dip kept at a pH of less than 5.5 the chemical was found to be stable under heavy use for 6 months and when allowed to stand for 4 months.

Weekly observations were made during the spring/summer control programme on eight field dips charged with chlorphenamidine (0.04 per cent) and ethion (0.075 per cent). Results confirmed previous experimental evidence that the pH must and can be regulated to less than 5.5 for economic management of the dips.

The Lismore B.T.C.L. modified the UV method for determination of chlorphenamidine to recover all the chemical from a dip sample and to determine loadings on hair. It also developed a chlorphenamidine pour-on formulation which was found to give 94 per cent control of ticks at the Wollongbar C.T.R.S.

I.C.I. and Ciba/Geigy provided facilities in Queensland and actively collaborated in dosage response spray trials on their respective chemicals, Promicide and Dipofene. Both acaricides were highly efficacious at recommended strength against the Mt Alford resistant strain of ticks.

Bioassay test for analysing field dip samples: A test involving dunking adult ticks was developed and used to demonstrate that the biological efficiency of 271 ethion and 209 Delnav field dips was equal to or greater than clean emulsions of recommended field strength. Results were confirmed by spraying infested animals with samples of the least efficient dips.

The laboratory test also showed that materials such as soil, manure, activated carbon and triple superphosphate onto which some organophosphate could be absorbed, did not impair efficiency of ethion.

This study has proved that the successful control of susceptible ticks during the last 10 years was based on very efficient dips.

Rational Development of Acaricides to Control Cattle Tick

This research project, aimed at understanding the insensitive acetylcholinesterase (AChE) resistance mechanism and development of inhibitor designs to be used as acaricide models, has continued in co-operation with CSIRO, at the Long Pocket Laboratory, Queensland.

The technique, developed for solubilizing the particulate AChE, has been modified to provide a means of isolating the key AChE component responsible for the resistance mechanism. This component has been used for assessing the potency of synthesized inhibitors and substrate studies.

Synthetic methods have been developed for extensions of the P-o-aryl and P-o-alkyl bonds of a basic inhibitor molecule. Kinetic assays of the compounds synthesized, have shown that such structure modifications can reduce the resistant: susceptible AChE insensitivity ratio, and improve the selectivity of the inhibitor for cattle tick compared with bovine AChE.

Titration of the active site of the AChE enzyme with ^{14}C -labelled inhibitor has shown that the lower AChE activity associated with the resistance mechanism is due to a lower turn over number for the substrate rather than any loss in number of enzyme molecules.

Mastitis

The mastitis control programme: The 3-year study on the effect of a comprehensive control system applied in thirty-five herds throughout N.S.W. demonstrated the benefits of such a programme in reducing disease incidence and in increasing production and overall economic return.

Quarters positive to the Rapid Mastitis Test were reduced from 33 to 11 per cent; quarters infected with pathogens were reduced from 32 to 15 per cent; and the number of clinical cases/100 cows/year fell from 72 in the first year to 35 in the third year. Both milk and fat production/cow/lactation increased by 19 and 27 per cent in years 1 and 2 when compared with the matched herds in the same districts. Of the 15 herds so far analysed, 14 showed increases in production. Initial cost benefit analyses are most promising in that for all farms analysed the value of the increased butterfat production attributable to the mastitis control programme exceeded the additional costs involved. More economic work is planned.

The control programme involved no increase in milking time; in fact, the throughput of cows actually increased from twenty-three to twenty-five cows/man/hour. Results show that machines require servicing every 12 months.

The effectiveness of the programme led to the issue of mastitis control guidelines for farmers based on a simple programme of proven value, and is leading to an integrated team approach in extension.

Milk quality: The electronic cell counting technique (Coulter) developed at the B.C.R.I., Rydalmere is being used as a rapid objective method of assessing udder health and milk quality. A further 18,000 samples were analysed as part of regular surveys on bulk milk from herds throughout N.S.W.

The yellow stain on filter discs continued to be a major problem for some producers. Research showed that the stain intensifies with storage of milk, and appears to vary with the vacuum level and porosity of the filter used. Studies are continuing at Glenfield V.R.S., the B.C.R.I., Rydalmere and Wollongbar A.R.C.

Individual control measures: The bacteriology of using foam cloths instead of paper towels to dry the udder after washing with running water prior to milking is being studied at Wollongbar A.R.C.

Excretion times for intra-mammary infusions: At the B.C.R.I., Rydalmere and Glenfield V.R.S. a total of eleven commercial antibiotics has now been screened to determine the withholding period for milk. This research has contributed to the development by the Technical Committee on Veterinary Drugs of a protocol to be used in gathering data necessary for the registration of such drugs.

Mucosal Disease

Mucosal disease (MD) viruses of both cattle and sheep have been recognized more commonly than previously, largely through improved techniques for the isolation and recognition of non-cytopathogenic strains by the demonstration of antigen in infected cell cultures.

The improved means of isolating and identifying MD viruses has allowed more scope in MD research. Virus has been recovered from two animals carrying group-specific precipitating serum antibody. The antibody was heterologous towards the virus isolated in the more strain-specific neutralizing character and this has important implications in regard to current concepts of MD pathogenesis. In further regard to strain differences within the bovine MD viruses it has been possible to establish diagnosis by virus isolation at the active stage of disease from the rare animals which recover after showing clinical signs and from which strain-specific anti-serum is then available.

Internal Parasites of Cattle

Helminthosis: Studies conducted since 1964 to determine the economic importance of internal parasitism to the cattle industry and to provide information on which sound control programmes can be based have been continued.

Evaluation of anthelmintic treatment at weaning and thereafter twice at 8 weekly intervals showed an advantage of up to 20 kg weight gain for treated animals by 15 months of age. It is possible that the increase in weight gain may allow earlier mating of treated heifers.

A specific programme for the control of *Ostertagia* infection in yearling cattle on a tablelands property by one anthelmintic treatment in late July at the time of moving to "spelled" pasture, resulted in

moved heifers, when compared with heifers which remained on the contaminated paddock, showing lower levels of parasitism and 11 kg extra weight gain 8 months later.

The success of grazing-management trials for parasite control indicates the need for more detailed work, with emphasis on the integration of control programmes in whole-farm management and economic evaluation of results.

Fluke and other liver parasites: Higher fluke burdens were considered to be responsible for lower weight gains in steers which were running with sheep when compared with steers running separately. These observations were made on the northern tablelands.

On the North Coast, livers of cattle were surveyed at slaughter and the occurrence of liver fluke found to be widespread. However the hepatic pathology was less than expected. In the same survey a substantial incidence of hydatidosis was observed. Properties of origin of cattle affected by these parasites are being traced to obtain epidemiological data.

Bovine brucellosis diagnosis

Current work at the District Veterinary Laboratory, Wollongbar has shown that the complement fixation test for bovine brucellosis which is used extensively to distinguish reactions to infection from reactions to vaccination and is therefore fundamental in the forthcoming brucellosis eradication scheme, can be adapted to micro-techniques and can be automated, with substantial savings in labour, materials and equipment.

Supplementary tests based on the Coombes technique and mercaptoethanol degradation of antibody are also being investigated.

PIGS

Nutrition of the Growing Pig

Minerals and vitamins: Experiments continued at Wollongbar A.R.C. examining the response of growing pigs (raised under intensive systems) to mineral and vitamin supplementation of practical pig diets. The diets were based on the five grains (wheat, barley, oats, sorghum and maize) and two protein supplement types (animal and vegetable). A base supplement of vitamins A and D₃ was added to all the diets.

The type of protein supplement used with grain would appear to virtually determine the need for mineral supplementation. In experiments where animal protein was the supplement used, the attainment of sound pig performance did not require a mineral supplement. A mineral supplement was essential where a vegetable protein supplement was used. In such cases, the response appeared to be due largely to sodium, chlorine, calcium and phosphorus.

Only minor responses to vitamin supplementation were found.

The use of a vitamin supplement at the same time as minerals in a maize/vegetable protein diet improved performance over minerals alone. This was felt to be due to the correction of a niacin deficiency in the diet. There also appeared to be a response to vitamin supplementation of an oats/vegetable protein diet, possibly due to niacin and vitamin B₆ deficiencies. This response was not evident when minerals and vitamins were used in combination.

Investigations were continued into the suitability of albino rats as pilot animals for the studies on the mineral nutrition of the growing pig. Despite earlier favourable results it is now apparent that the rat cannot be used for questions involving calcium and phosphorus nutrition. Deficiencies of these elements could not be induced in rats though they were readily induced in pigs.

The value of the rat in studying high level copper supplementation of pig diets was studied following reports of their unsuitability. Initial results have tentatively confirmed the reports but further data have yet to be considered.

An experiment in which salt was added to a wheat/vegetable protein diet has shown the importance of salt in rat nutrition. Performance was improved dramatically. The relationships of sodium, chlorine and potassium in nutrition are being further studied.

Evaluation of sweet lupins: Rat responses were used to evaluate the use of sweet lupin seed as a protein supplement for pigs. It was found to be unsuitable as the sole protein supplement to wheat in diets fed to rats. However, it could be used to replace up to 75 per cent of protein supplied by meat and bone meal without adversely affecting performance. For maximum performance, a level of 50 per cent of supplemental protein from each of sweet lupins and meat and bone meal was necessary.

The addition of a complex mineral supplement corrected the very poor performance produced by a diet for rats in which sweet lupin seed was the sole protein supplement. Rat performance was further improved by the addition of 0.1 per cent methionine at the same time as the minerals. A higher level of

0.25 per cent methionine was of no further benefit. Nor was there any response to the addition of 0.1 per cent lysine.

Evaluation of rapeseed meal: The use of local rapeseed meal as a protein supplement in diets was examined in pilot experimentation with rats. The levels used, at 5, 7.5 and 10 per cent of the diet, were higher than is generally recommended overseas for pigs. Cost makes these higher levels attractive. Rat performance was depressed by all levels of rapeseed meal compared to a standard wheat/meat and bone meal diet, although recent Victorian results suggest that a different response to rapeseed meal is obtained with the growing pig.

Reproduction

Workers located with CSIRO, Prospect, have continued their investigations into the value of the hormone prostaglandin for the synchronisation of oestrus in sows. Initial work demonstrated that prostaglandin F was present in the blood draining the uterus and/or ovary at the time of luteal regression in the sows' oestrus cycle. Recent results suggest that synchronisation of oestrus in sows may not be as promising as it is in other domestic animals. Several methods of administering the hormone will be examined to determine if these will cause any variation in the sows' response.

Carcass Measurements and Information Service

As a result of a feasibility study into the implementation of a National pig carcass grading system, two projects have been commenced.

Carcass measurement survey: A survey of measurements from 40,000 pig carcasses is being conducted to determine a suitable system of carcass description. The survey is being conducted by extension officers in each State and is being co-ordinated from Wollongbar A.R.C.

Economic evaluation: The costs and benefits of the proposed measurement and information service are being examined by the Division of Marketing and Economics. Techniques are also being developed to evaluate whether, and by how much, a uniform carcass measurement and description service might improve the information available to market participants, and what value the participants place on the additional information.

Disease

Pleuro-pneumonia: A severe porcine pleuro-pneumonia due to *Haemophilus paraaemolyticus* was recognized as the cause of death in a single large commercial piggery investigated from Glenfield V.R.S. The disease was reproduced experimentally.

Piglet mortality: A survey of the causes of piglet mortality in commercial piggeries has been commenced based on the Wollongbar District Veterinary Laboratory.

Economics

Econometric model: Preliminary work has been undertaken to develop an econometric model of the N.S.W. pig industry. The model will provide insights into the principal forces affecting price, quantity supplied and the inventory of pigs, and it may be used for forecasting purposes.

POULTRY

Breeding for Meat Production

Broiler breeding: The broiler breeding programme, commenced in 1959 at the Seven Hills Poultry Research Station, aims to provide estimates of genetic parameters of interest to broiler breeders and to investigate present and likely future genetical problems facing the broiler industry. One of the major studies associated with this project is an investigation being conducted into the inheritance of food efficiency in broilers and its relationship with growth rate.

Leg weakness: In a multidiscipline investigation into leg weakness in broiler chickens, the main initial emphasis is on breeding lines of experimental birds with a high level of susceptibility to this syndrome. As leg weakness in broiler chickens appears to be associated with tibial dyschondroplasia, selection is being based on the presence of this condition. The first generation of this breeding programme has indicated a wide range in the incidence of tibial dyschondroplasia between the 20 sire families. The distribution of these sire families is strongly bimodal indicating that a dominant sex-linked gene of large effect could be associated with a high incidence of this disease. The results indicate that genetic selection will be effective in providing the high incidence lines required to assist biochemical and histopathological research into this problem.

A study has also been made into the normal developmental histology of bone growth in chickens from one week of incubation to 20 weeks of age. Electron photomicrographs taken of the cartilaginous plug of a small number of chickens suffering from tibial dyschondroplasia have indicated the presence of a virus-like particle that is apparently causing nuclear damage.

Breeding for Egg Production

Selection limits: Previous results from the egg breeding programme at Seven Hills P.R.S. suggested that Australian egg production lines could be at a selection limit for egg production. Subsequently, a comprehensive analysis of Australian Random Sample Laying Test data has indicated that breeders are at a selection limit for egg mass production. The upper boundary of this limit appears to be around the equivalent of 220 two ounce eggs to 66 weeks of age.

Marek's disease: A breeding programme to produce a line of Marek's disease susceptible birds has been commenced at Seven Hills P.R.S. in conjunction with Glenfield V.R.S. and the University of New England. These birds are required for both the testing of new vaccines and the routine quality testing of vaccines produced for commercial distribution.

Nutrition

Sorghums: A comparison of red and yellow sorghums has established little difference between them in nutritive value when included in the diet of either broiler chickens or laying hens.

Sex of broilers: As some retail chicken markets require uniform size of dressed chickens for efficient operation, some broiler growing organizations are rearing the sexes separately to overcome the problem associated with the faster growth rate of male chickens. An investigation into the separate rearing of male and female broiler chickens has failed to find any specific sex differences in either dietary requirements or age of change to the finisher diet. However, for both sexes, increasing the age of change to the finisher diet increased final body weight and improved both food efficiency and economic return.

Protein meals: Further studies into locally available sources of vegetable protein have indicated that ground lupin seed can be included in broiler diets at levels up to 24 per cent, that rapeseed meal should not be included at levels greater than 3 per cent, and that sunflower seed oil meal can be included at up to 7.5 per cent as long as dietary lysine and energy contents are adjusted.

Turkey diets: In a continuing investigation into the nutritional requirements of Australian White turkeys between 9 and 14 weeks of age, an increased protein level resulted in improved food efficiency and economic return. In another experiment, the inclusion of lupin seed meal at levels up to 16 per cent of the diet had no adverse effects on turkey growth rate.

Husbandry

Controlled environment: A study of controlled environment and conventional housing at Seven Hills P.R.S. indicates that controlled environment housing is successful in reducing the effect of temperature extremes upon egg production and mortality.

Restricted feeding: In an experiment to determine the optimum feed restriction pattern during rearing and laying, the interim results indicate that the laying performance of some of the restricted lines is superior to that of *ad lib* fed hens.

Laying cages: Interim results of an investigation of size and stocking density of laying cages indicates that colony size and feeding space have a greater effect on laying performance than stocking density.

Disease

Marek's disease: The sequence of infection with strains of this virus during the growing period are known to be important in determining the subsequent disease incidence. Also attenuated strains of the related herpes virus of turkeys (HVT) are known to induce immunity.

Following failure of vaccine trials using HVT due to extraneous agents, extensive laboratory tests have been undertaken at Glenfield, in co-operation with Sydney University to confirm the safety of HVT for chickens. Subsequent field trials showed the vaccine to produce a six-fold reduction in the incidence of Marek's disease.

Economics

Poultry feeding: A 2-monthly least cost feed formulation service has been initiated at Seven Hills P.R.S. This service is providing poultry farmers and extension personnel with contemporary pricing, feed formulation, and ingredient purchase information.

Supply analysis model: Research is continuing into the development of a supply analysis model for the egg industry. A linear programming approach has been adopted which attempts to take account of such factors as taxation, consumption, farmer objectives and time. Some implications of the Egg Industry Stabilisation Act upon production management decisions have been evaluated. It is anticipated that egg producers will modify some management factors, resulting in an increase in egg production per hen.

Industry outlook: An examination of the principal factors influencing the demand for and supply of Australian eggs suggests that egg production should fall as hen quotas become effective and that export outlets for eggs will continue to diminish as the world import demand for eggs and egg products decreases. The domestic market offers some scope for growth, but only if eggs are offered in the forms desired by consumers.

RESEARCH IN BIOLOGY AND CHEMISTRY

ANIMAL DISEASE

(See also sections dealing with individual livestock species)

Newly Identified Diseases

Chlamydial kerato-conjunctivitis in koalas: Current studies at the Armidale District Veterinary Laboratory indicate that a *Chlamydia* sp. is the specific causal agent of kerato-conjunctivitis in koalas which, without treatment, appears to progress and terminate fatally. Treatment trials have been undertaken and an ophthalmic preparation containing oxytetracycline and polymyxin B has been found to be effective.

***Centaurea solstitialis* intoxication of horses:** Peripherally to investigations into possible viral encephalitis in horses, a nigropallidal encephalomalacia was observed in horses grazing pastures in which *Centaurea solstitialis* was dominant. This plant, known locally as yellow burr, has been credited with producing nigropallidal encephalomalacia in California.

Technology of Animal Disease Research

Long-term storage of *Vibrio foetus*: Whole milk was determined to be the most successful medium in which *Vibrio foetus* might be freeze-dried. This diluent allowed recovery of the organism for at least 6 years.

Mucosal disease virus, group-specific antigen: Antigen which is group-specific for the Mucosal Disease/Swine Fever group of viruses can be demonstrated in MD infected cell cultures after freeze-lysis of the cells and elution of the antigen by proteolytic enzyme action.

Recent observations have indicated that the group-specific antigen is closely associated with the membranous debris of infected cells, providing a means for its purification and morphological characterization.

It has also been demonstrated that the sensitivity of gel diffusion precipitin techniques is directly dependent on the concentration of reference reactants, thus providing means by which the sensitivity of the technique may be enhanced.

Dithiothreitol (DTT) as an aid to virus isolations: The use of DTT as a mucolytic agent to improve the recovery of viruses from mucus was investigated in relation to the virus of Infectious Bovine Rhinotracheitis (IBR). This virus was found to be inactivated by DTT.

Use of bovine embryo cells: Cell cultures prepared from whole bovine embryos were examined as general utility hosts. They were found to be particularly suitable for IBR virus isolation and are also useful hosts for the production of MD virus group precipitating antigen.

Studies of *Histophilus ovis*: The biochemical and growth characteristics of *Histophilus ovis* and related organisms have been determined and essential differences recognized. This will have immediate value in the laboratory diagnosis of specific infectious entities.

NOXIOUS AND FERAL ANIMALS

Rabbits

Rabbit bait comparison trials: During the year, two trials were completed in this series working from the Glenfield Noxious Animals Research Laboratory. Both of these trials were part of a programme to develop a "one-go" method of poisoning rabbits with pollard and bran pellets. In both of these trials the bait was applied from the air. Both sites were near Reid's Flat in an area where pellet bait has not given

consistently good results. Problems, apparently associated with the pellets becoming unpalatable to rabbits after several nights on the ground, caused poor results with the "one-go" operations. This unpalatability appears to be caused by fermentation after the pellets are wet by dews and soil moisture. Further trials with pellets treated to prevent this fermentation are under way.

The "Tarbaby" method: A large scale practical assessment of the use of this method was completed during the year. Young Pastures Protection Board conducted the assessment, with departmental supervision and advice. The assessment at two sites, took over 6 months to complete.

Numerous problems associated with the handling, storage and efficacy of this method were revealed during these trials.

Control in the Western Division: The efficacy of a warren ripping operation continued to be monitored at one site. During the year over 2,000 warrens were ripped and the number of reopened entrances per warren recorded 2 months after ripping. Two types of machines were used and the comparative costs and efficacy of these two machines recorded. Much lower reopening rates were recorded in warrens ripped during the hot drought conditions from November, 1972, to January, 1973 than previously recorded. During this period reopening rates were well below 10 per cent of warrens.

Feral Pigs

Ecology: Over 300 animals were tagged and released on the Warren site; 44 tagged animals were recaptured during the tagging operations but only 9 tagged animals were collected during April and May when 645 animals were shot.

High floodwaters restricted access to the areas where the bulk of the tagged animals were released.

The data collected indicated that pigs have permanent camps and move no further from these camps than necessary to collect food. However, during periods of food shortage movements increase and one instance of a mass migration of 10 to 15 miles was recorded.

Drought conditions during spring and summer of 1972 caused a drop in the condition of the pigs at the three sites, Yantabulla, Warren and Moree and a decline in the fertility of sows under 2 years of age. No sows were lactating during the worst period of feed shortage, but sows over 2 years of age were still pregnant. When the drought broke, all sows over 12 months of age had a litter within 4 months.

Control: Initial trials on the use of 1080 poison for poisoning feral pigs were undertaken with the co-operation of the Moree Pastures Protection Board. 1080 is safe to handle and mix and poses minimal risk with secondary poison of birds whilst most of the other poisons commonly used are very toxic to birds and man.

PLANT ECOLOGY

Vegetation Mapping

This work, carried out from the National Herbarium, Royal Botanic Gardens, is continuing both in the northwest of the State and in the Sydney-Wollongong district. A survey of the natural vegetation of the floodplain of the Hawkesbury River and its major tributaries was completed. The report and accompanying maps provide data on both present vegetation and its distribution before settlement. In addition, a vegetation map and accompanying memoir for Lord Howe Island are being finalized.

Freshwater Algae (See also section dealing with water quality.)

Ecological studies are being made on freshwater algae in dams.

Marine Algae

Marine algae are being examined at Botany Bay and Jervis Bay to determine the effects of pollution and to provide baseline ecological data so that effects of future pollution can be determined. The economically valuable agar-producing alga *Gracilaria confervoides* is under study to establish appropriate culture methods. The various algal ecology studies are being made in conjunction with the B.C.R.I., Rydalmere, with the Fisheries Branch of the Chief Secretary's Department and with University staff members.

Vegetation Establishment

Experiments are underway at Maitland to determine methods of establishing vegetation on sludge ponds and chitter heaps, to reduce dust nuisance from coal washery refuse. Germination and early growth is aided by appropriate nutrient addition, pH adjustment, addition of soil and furrowing of the surface.

SYSTEMATICS

Plant Systematics

Studies in progress at the National Herbarium covered many of the more prominent and more economically important groups of the Australian flora, notably grasses, pasture legumes, eucalypts and acacias. These and a wide range of other plant families and genera received particular attention leading to improved classifications and better knowledge of relationships.

A very substantial section of the treatment of the Gramineae for the Flora of New South Wales was completed for publication. New grass species in *Sporobolus* and *Echinochloa* have been distinguished and work on anatomy and its association with photosynthetic processes is contributing to knowledge of the major groupings within the grasses. In the sedges (Cyperaceae) and saltbushes (*Atriplex*), similar investigations of details of cell structures and arrangements of tissues are aiding classificatory studies. The necessary electron microscopy facilities for this work are being provided by the University of Sydney and members of the university staff are collaborating in the project. A study of the bipinnate wattles is nearing completion and the phytochemical survey of heartwood flavonoids of Australian *Acacia* species is continuing. Detailed taxonomic studies of *Zieria* (Rutaceae) are being made in association with a survey of pollination and breeding systems in allied genera.

Other projects cover *Plantago* (new species distinguished and a survey of chromosome numbers and chromosome morphology in native and naturalized species) and *Juncus* (further elucidation of the about seventy Australasian species) and collaboration with chemo-taxonomic studies on the genus. In Epacridaceae an extensive revisionary study has been undertaken while a detailed treatments of the Australian species of *Tetralochea* (Tremandraceae) is nearing completion. New species have been distinguished and classificatory problems elucidated in *Cassia* (Caesalpiniaceae), *Celastrus* (Celastraceae), *Craspedia* (Compositae), *Crotalaria* (Papilionaceae), *Eucalyptus* (Myrtaceae), *Galium* (Rubiaceae), *Grevillea* (Proteaceae), *Helichrysum* and *Olearia* (Compositae), *Pilea* (Urticaceae), Piperaceae, *Prasophyllum* (Orchidaceae), *Rhytidosporum* (Pittosporaceae) and *Stylidium* (Stylidiaceae).

Compilation of the census of plants of the State is continuing, with nomenclatural checking of the Gymnosperm and Monocot groups almost completed and data assembled for a considerable section of the Dicotyledons.

Fungal Systematics

The Biology Branch Herbarium, B.C.R.I., Rydalmere is now the largest mycological collection in Australasia, with over 36,000 specimens. The programme of indexing and computer recall of herbarium information has continued and 7,000 specimens have been filed on computer.

Data from a comprehensive survey of the species of take-all fungi have been prepared for publication. A detailed study is being made of taxa in the genus *Phialophora* which resembles the take-all fungi.

The host ranges have been determined for a second species of poplar rust (*Melampsora larici - populina*). Surveys of its distribution have shown it to be widespread in southern N.S.W.

Life-cycle studies on the phalaris ergot fungus (*Claviceps phalaridis*) have continued.

Taxonomic investigations have been made of *Ramularia pitereka* and allied taxa and of the genera *Dilophia*, *Ravenelia* and *Coprinus*.

Insect and Nematode Systematics

The collection of *Curculionidae* (Weevils) was increased during the year by 1,160 specimens to a total of 25,330. Detailed distributional data was prepared for 15 species. Studies on larvae of *Trigonotarsus* have contributed to knowledge about the broader classification of the family Curculionidae.

A close study of the spiral nematode collection has added new information to the current comprehensive survey of plant and soil nematodes in N.S.W. In other research two species of *Heterodera* have been studied; the relationships with their overseas counterparts have been clarified.

NEW APPROACHES IN ENTOMOLOGY

(See also sections dealing with individual crops and livestock species)

The research programme into new approaches in entomology at the B.C.R.I., Rydalmere is aimed at developing methods of insect control that do not rely on regular spraying of broad spectrum insecticides.

Regulation of Ovarian Growth in Hemiptera

The compound 9 ketotrans 2 decenoic acid when applied at 20 ug per female bronze orange bug mimics the natural inhibitor of ovarian growth.

Feeding Processes in Insects

Investigations have confirmed overseas work that two organotin compounds at rates of the order of 0.03 per cent inhibit feeding in insects without actually repelling them.

Technique for Detecting DDT Resistance in First Instar Bollworms

Newly hatched DDT resistant larvae survive on soybean leaves dipped in 0.02 per cent DDT, whereas susceptible larvae of the same age are killed within 48 hours. Previously larvae were not tested until they were 18–20 days old, during which time severe larval losses can occur due to cannibalism and disease.

Migration Studies with Budworm and Bollworm Moths

A method has been developed using the appearance of the female reproductive system by which migrants can be distinguished from local moths, and an estimate made of when egg-laying by that flight of moths will begin.

PESTICIDE CHEMISTRY AND RESIDUES

Pesticide Uptake into Pasture and Grazing Animals

Analyses conducted by B.C.R.I., Rydalmere of dairy cows grazing pasture areas previously soil-treated with dieldrin and heptachlor insecticides (1.12 kg/ha) indicate significant pesticide contamination within the first 12 months grazing period.

Although pesticide levels in pasture were low (0.03–0.04 ppm), levels in body and milk fat had risen from less than 0.1 ppm to 0.21 and 0.37 ppm (dieldrin) and to 0.15 and 0.28 ppm (heptachlor). 37 per cent of the milk samples exceeded the 0.3 ppm U.S.F.D.A. actionable levels.

Famphur Residues in Subcutaneous Cattle Fat

Cyanamid Australia, the Wollongbar C.T.R.S., and the Lismore B.T.C.L., collaborated in a trial in which biopsy samples were taken at intervals over 21 days from beasts treated topically with different rates of famphur. Residues decreased rapidly with a half-life of about 12 hours and were negligible by 8 days.

DDT Residues in Dip Yard Soil

Following the large-scale use over 10 years of DDT dips for the control of cattle tick in northern N.S.W., a survey is being conducted by Lismore B.T.C.L. to study the DDT content of soil in various dip yards. Residue levels from two dips so far examined ranged from between one and two parts per million to nearly 6 per cent DDT.

Pesticide Residues in Eggs and Poultry Meat

DDT contaminated rice hulls: In work conducted at the Seven Hills P.R.S. the use of DDT contaminated rice hulls as deep litter was examined from the residue viewpoint. Poultry analyses conducted at Rydalmere show that a serious residues hazard exists and publicity is being given to alert producers to this danger.

Mancozeb/lindane treated wheat: Analyses conducted by the Lismore B.T.C.L. indicated that 3 weeks feeding of a diet consisting substantially of wheat dusted with normal rates of mancozeb/lindane seed dressing produced significant lindane residues in egg yolk (16.5 ppm) and carcasses (20.9 ppm), but no mancozeb residues were detected. After 4 weeks on untreated feed, egg residues (ca 2 ppm) were still excessive, while bodyfat levels (1.86 ppm) approximated Australian tolerances.

Residues in Fruit and Vegetables

Bromide: Trials involving ethylene dibromide and methyl bromide fumigation of bananas, apples and capsicums, were conducted at Gosford C.W.R.L. to investigate practical disinfestation treatments for the control of fruit fly and light brown apple moth pests. Inorganic bromide residues resulting from the treatments were measured at the B.C.R.I., Rydalmere.

Bananas and apples had acceptable levels of bromide, but capsicums were excessively contaminated following the recommended levels of treatment.

Benomyl: The effect of experimental and commercial treatments of benomyl on residues in fresh peaches, plums, tomatoes and mushrooms were investigated. Analyses conducted by the B.C.R.I., Rydalmere indicated that all post-harvest dip, preharvest spray, and mushroom-bed treatments gave acceptable residues when related to current Australian tolerances for stone fruit and vegetables.

Pesticide Residues in Cottonseed Hulls

Following the cottonseed hull survey conducted on the 1970–1 crop, a further survey was conducted on hulls from the 1971–2 crop, to indicate the effects of varying climatic conditions and spray practices. DDT residue levels were within acceptable limits for stock feeds and were significantly lower than previously found possibly indicating that fewer DDT sprays were applied during 1971–2.

Pesticide Contamination of the Namoi Cotton Environment

DDT: Following severe flooding of the Namoi Valley in 1971, surveys were conducted in 1971–2 from the B.C.R.I., Rydalmere to investigate the possibility of increased contamination of non-target aquatic areas. Analysis of river sediments collected in 1971 indicated movement of DDT downstream from the cotton area along the Namoi River almost to the Namoi/Barwon junction. High DDT levels were detected in aquatic birds collected in 1971 following the floods (ducks averaging 104 ppm) and in predatory type species (averaging 242 ppm) collected in 1972. Fish collected from the Namoi River in late 1971, 10 months after the floods, averaged only 0.43 ppm DDT, increasing to an average of 2.1 ppm DDT following the 1972 spraying season, with three samples (14 per cent) exceeding the 5 ppm U.S.F.D.A. tolerance.

The absence of any significant accumulation of DDT contaminated sediments in the Barwon/Darling River system suggests that contamination so far has remained largely localized within the Namoi Valley.

Endrin: Investigations in 1973 have revealed the presence of endrin in addition to DDT in river water, sediments and algae, which reflects the abnormally high usage of this chemical during the 1972–3 season.

Pesticide Methodology

Benomyl: Factors affecting the stability of benomyl under laboratory conditions was studied at the B.C.R.I., Rydalmere to improve current methodology. Degradation was found to be markedly influenced by analytical solvent polarity; more rapid techniques for determining benomyl in dips and dipped fruit were developed.

Phenothiazine: A method for animal residues is being developed at Lismore B.T.C.L. using bromination and electron capture gas chromatography.

Organophosphates: Techniques were developed at Lismore B.T.C.L. for the analysis of ethion in cattle blood, based on acetone extraction coupled with a supersonic mill.

WATER QUALITY

Removing Soluble Phosphorus to Control Algal Growth

At the B.C.R.I., Rydalmere, the mechanism of reducing phosphorus levels in water by flocculation with alum was studied. It was shown that phosphate ions are absorbed onto the floc, and a relationship was established between initial and residual phosphorus levels for a given treatment. This work has enabled a more accurate assessment of alum dosing rates (0.5 ppm) necessary to reduce soluble phosphorus in farm dams below the levels which stimulate blooms of blue-green algae toxic to livestock. In a joint project with the National Herbarium, twelve dams will be treated and monitored for phosphorus levels and algal growth.

SOILS

Soil Survey

A soil survey was commenced to help assess the feasibility of using the extensive drained swamps of the Shoalhaven River flood plain for intensive cropping and pasture production. The fine textured swamp soils vary in acidity, the depth of their surface peat and the depth to and salinity of the water table. Although a more detailed survey of Terara Swamp and adjacent river levee soils has yet to be done, a preliminary assessment suggests that while greater pasture production will be possible, intensive cropping may not be practicable on these soils.

Soil profiles on the sites of manganese toxicity trials in the Albury district were examined and monoliths made. There is evidence that the occurrence of manganese toxicity under water-logged conditions is related to soil profile morphology — particularly the structure of the A and B horizons as these affect rooting depth.

Soil Physics

Studies of crusting soils: Surface crusting which can prevent seedling emergence of summer crops is a problem on the lighter irrigation soils on the Macquarie River. Marked increases in bulk density on

wetting and drying, reduced infiltration rates due to slaking and dispersion and prolonged dispersion of their clay under water were shown to be features of such soils. Possible control of these phenomena by restricting the water supply rate is being investigated.

Soil conditioners: An irrigation field trial at Leeton to test one of many commercial soil conditioners said to improve structure stability has shown, so far, no benefit in this direction.

Determination of moisture characteristic: Contrary to expectation it was found that for a red basaltic soil from Alstonville the curves relating moisture content to moisture tension for disturbed and undisturbed samples were quite different down almost to pF 4.2.

Soil Chemistry

Potassium: Calibration of soil tests for potassium by means of field trials on the coast and tablelands was continued. All exchangeable potassium above 50 microequivalents per cent (20 ppm) is now considered available to the plant and, as well, a proportion of the resin extractable (non-exchangeable-available-potassium or N.E.A.P.) fraction.

Selection of sampling areas is complete for extension of the soil potassium survey from the southern pilot area to the rest of the coast and tablelands regions. Field sampling will shortly commence. Five areas for survey (about 15 per cent of the total area) have been carefully chosen to give a representative coverage of soils, rock types and land use.

Phosphorus: Work on soil phosphorus testing was continued. However drought again plagued the field trials on the tablelands. It now seems that one set of soil test values to define "high", "medium" and "low" categories is probably only applicable over similar soils on a single rock type. Further, the "high" category can be delimited generally by lower test values than were previously used.

A marked response to lime was obtained in phosphorus trials in the Goulburn district on both improved and unimproved sites. The reasons for this are being sought.

Nitrogen: Studies on soil nitrogen at Wagga A.R.I. were continued. A rapid distillation of soil with caustic soda was developed as a measure of total nitrogen and its usefulness is under study.

Decline of soil nitrogen under the cropping phase following pasture has been shown to vary from 50 to 70 kg per hectare in the top 10 cm over a 3-year period. The rate of decline seems to be related to the level of "available" soil phosphorus as measured by the Mehlich test.

The nitrification inhibitor "N — Serve" has been shown to delay maturity and increase the number of heads on wheat grown in the glasshouse.

Clay Mineralogy

High phosphorus fixing soils from Glen Innes were shown to have appreciable (up to 50 per cent of the clay) amorphous material coating the crystalline clay minerals; this helps to explain their behaviour towards phosphorus. On the other hand a comparison of crusting and non-crusting soils shows them to be little different in their clay mineralogy.

Soils from the pilot area of the potassium survey of the coast and tablelands contained mainly kaolinite and less amorphous material than was expected.

To allow a more quantitative measure of clay minerals present in soils a series of standard mixtures of the range of constituents in the clay fraction are being prepared with which X-ray traces and powder photos of unknown samples can be compared.

PLANT NUTRITION

Phosphorus, Sulphur and Molybdenum

Upper Hunter: Twenty soils were tested in the glasshouse using lucerne and phalaris as the indicator species. Where there were deficient elements in the glasshouse experiments, these elements were then further tested in the field. In subsequent field trials there were significant and economic responses to phosphorus on a red clay loam at Muswellbrook, phosphorus and sulphur on a light basaltic soil near Murrurundi and phosphorus and molybdenum on a shallow yellow podzolic soil near Singleton.

Phosphorus

Taree area: In the current experiments, a culmination of four years' work, results show how extreme phosphorus deficiency can be on the coast. On one site there was a straight line response up to 1 000 kg per hectare of superphosphate in the first year. The response to phosphorus is largely governed by the amount of phosphorus applied in any one year. Residual effects are small. Potassium is only necessary where fertility is depleted. Some molybdenum deficiency has also been reported.

Southern slopes: Field, glasshouse and laboratory studies are being carried out at Wagga A.R.I. to assess the effectiveness of phosphorus applications to pastures. Preliminary findings suggest that clover pastures do not require topdressing when the available phosphorus level in the soil is above 18 to 20 ppm (Melich). This critical value will be confirmed during the next 12 to 18 months by continued monitoring of soil and pasture phosphorus levels in a grazing situation. For a particular site it seems that previous applications of phosphorus can influence phosphorus levels and pasture production for up to 10 years, if a total of 800 kg superphosphate per hectare is applied over a short period of 2 to 3 years.

Uptake studies: At Wagga A.R.I. low rates of phenyl phosphoric acid application to the seed at sowing promoted vegetative growth, grain yield and nutrient uptake for wheat and rape. Increases in growth of up to 50 per cent have been reported. However on legume crops such as field peas the chemical was found to have an adverse effect.

Aluminium and Manganese

Alstonville district: In an acid soil treated with aluminium at Alstonville T.F.R.S., bean plants responded slightly to lime applications but vigorously to phosphorus. Further work is planned to find out whether phosphorus is causing response purely as a nutrient or as a corrective for aluminium toxicity.

Albury district: Pastures studies from the B.C.R.I., Rydalmere have been concluded and have shown that manganese toxicity is caused by extreme climatic conditions such as waterlogging in winter and heat exposure in summer. Lime significantly reduced manganese levels but did not correct manganese toxicity under conditions of waterlogging or heat exposure.

Raising the Molybdenum Status of Maize

A satisfactory level of molybdenum must be maintained in certified hybrid maize seed to ensure good establishment on deficient soils. Spray applications were shown to be far superior to soil treatments as a means of raising the molybdenum status of grain.

Zinc Deficiency in Maize and Other Crops

Measurement of residual effects of heavy dressings of zinc to the soil have shown some decline indicated by a response to current spray applications in the second and third year after application.

SYMBIOTIC NITROGEN FIXATION

Production and Use of Legume Inoculants

Brown coal: Four types of brown coal were compared with peat as carriers of rhizobia for commercial legume inoculants. Two of the brown coals are promising and will be studied further at the B.C.R.I., Rydalmere.

Measuring effectiveness of nodulation: Methods for testing the effectiveness of rhizobia for commercial inoculants in field trials were compared in conjunction with Tamworth A.R.C. The percentage of plants nodulated could be reliably determined only when plants are spaced apart. Visual rating of strains was comparable to measuring yield of dry matter which should be determined on at least 2 m length of row.

Seed pelleting: A new method of pelleting seed developed with the CSIRO Division of Chemical Engineering and the Victorian Department of Agriculture uses a fluid bed technique to provide a hard outer skin to already inoculated and lime-coated seed. Preliminary results suggest that pellets containing 3–6 seeds embedded in inoculated brown coal may be particularly useful for aerial seeding.

Nodulation of Tropical Legumes

Temperature and nitrogen: The optimum temperature for nodulation and nitrogen fixation with three strains of rhizobia was 26° C for *Macrotyloma axillare* and 31° C for *Macropitilium atropurpureum*.

Variation within different sources of commercial “cowpea” strain CB 756 in ability to fix nitrogen with two hosts was shown to be directly correlated with time for nodulation. Addition of small amounts of nitrogen decreased time for nodulation and increased plant weight, nodule weight and nodule number. This effect was greater with the less effective subcultures of CB 756.

Slow nodulation: Studies have continued at Wollongbar A.R.C. into the causes of slow nodulation of *Glycine wightii*. Although 500 kg/ha of lime increased the percentage nodulation, neither lime nor superphosphate reduced the time for nodulation or improved early growth. Strain CB 756, used for *Glycine*, did not multiply in kraznozom soil even under favourable conditions of temperature and moisture or with additional lime.

Survival on seed: Rhizobia survived well on seed of *Vigna sinensis*, *Glycine wightii*, *Lupinus albus*, *Desmodium uncinatum* and *Glycine max* stored at either 25° C or 35° C. Survival was little affected by applying the bacteria in gum arabic alone or under a coat of lime or rock phosphate.

When strain CB 756 was applied to seed in gum arabic and stored under simulated field conditions for 8 hr at 50° C followed by 16 hr at 24° C numbers of rhizobia had fallen by 90 per cent after 11 days. Pelleting with either lime or rock phosphate or exposure to 100 per cent relative humidity during the period at 24° C increased the death rate.

SOIL MICROBIOLOGY

Fungal Resting Structures in Soil

Resting structures of most soilborne plant pathogenic fungi do not germinate in soil even under apparently favourable conditions unless supplied with exogenous nutrient. This phenomenon is called soil fungistasis and is of fundamental importance in the ecology of soil fungi and consequently, in the occurrence of soilborne plant diseases.

The cause of soil fungistasis has been obscure until current research at the B.C.R.I., Rydalmere identified a volatile factor of microbial origin and showed that it causes this phenomenon. Production of this factor is linked to the chemical composition of the soil and its prior cultural history. Manipulation of the soil micro-organisms that produce the volatile inhibitor should lead to the development of practical methods of biological control for many soilborne plant pathogens.

ANALYTICAL METHODS

X-ray Fluorescence Spectroscopy

The demand for rapid determinations of total sulphur in plants has been met by simplifying the processing of results from the X-ray fluorescence spectrophotometer located at the B.C.R.I., Rydalmere. Ignoring inter-element corrections, resulting in a small but not excessive loss of accuracy, permits the use of a desk calculator instead of a computer enabling determinations to be completed in a matter of minutes.

Atomic Absorption Spectroscopy

Urine and faeces samples were analysed at the B.C.R.I., Rydalmere for total sulphur using atomic absorption spectroscopy. These were for a project on wool growth and metabolism co-operative with Trangie A.R.S. Plant sap was analysed for zinc using the non-flame carbon-rod atomizer. It is proposed to apply this new technique to other fields such as water analysis when additional accessories are obtained for the Rydalmere instrument. It is more sensitive and utilizes smaller sample volumes than the existing flame atomizer. Less preparation of sample is required and solid material may be analysed directly.

"Autoanalyser" Automated Colorimetry

An electronic timer has replaced the mechanical type on the sampler of the Rydalmere instrument to improve precision and accuracy of the uniform location of "peaks" on the chart recorder with time. This timer permits research on peak shapes to adapt them to a digital direct concentration readout unit. This will enable the colorimeter and recorder modules to be replaced by a digital spectrophotometer.

Electron Microscopy

Plant sap samples were checked for the presence of rod-shaped virus particles. A method is being investigated into the more efficient detection of viruses in mushroom with initial promising results. The research programme of the instrument is centred around the potato virus Y group which include PVY, sugarcane mosaic, bean common mosaic, lettuce mosaic, passionfruit woodiness and watermelon mosaic viruses.

CLOUD SEEDING

The research project investigating the effectiveness of cloud seeding, based at Cobar, is now in its fourth year. The project compares rainfall over the "target area" with two adjacent unseeded "control areas". Target area rainfall for the 4 experimental years is also compared with that of the previous 40 years.

Although trends towards higher summer rainfall emerged from the first 2 years of the project, at this stage these are not statistically significant variations from normal.

BIOMETRICAL RESEARCH

During the year statistical computing operations were transferred from the Treasury A.D.P. Service Bureau to U.C. Compunet Ltd, and the opportunity was taken to improve and streamline existing computer programmes and to develop a number of new ones.

The programmes which have been developed for analysis of variance can analyse data from designs such as randomised complete blocks, split plots, latin squares, factorial designs, lattices, balanced and partially balanced incomplete blocks, and non-orthogonal designs. Another set of programmes performs simple or multiple regression analyses, regression screening and comparison of regression equations. Miscellaneous statistical procedures such as cluster analysis, chi-square tests of contingency tables, Bartlett's test of homogeneity of variance and a simple plotting routine have been programmed, and a powerful data manipulation routine allows listing, editing and magnetic tape storage of data.

This year research on experimental design and statistical methods has been confined to the solving of specific problems encountered by research workers in other fields. These are problems of design and analysis which arise during the planning or conduct of a particular research project. The results of many such projects are given elsewhere in this report.

AGRICULTURAL ENGINEERING

AGRICULTURAL MACHINERY

Tomato Harvesting

Development of a low-cost tomato harvester for local production has reached the final prototype stage at the Glenfield Agricultural Engineering Centre. Field tests have emphasised the beneficial effects of suitable soil cultivation and bed shaping procedures upon harvester performance.

Fruit Picking

A fruitpicking platform intended as an aid for manual tree fruit harvesting, is currently being developed. Preliminary trials with the first prototype showed a potential for increase in picking rates compared with the conventional harvesting system.

Hay Handling

Equipment with which one operator can transport and stack half-sized hay bales, has been designed, constructed and tested. Some further development and testing, particularly of a suitable loader, is still required to make a viable hay handling system.

Minimum Tillage

The 1972 field trials to compare minimum tillage and conventional cultivation techniques for the growth of fodder oats showed that the latter technique tended to produce higher dry matter yields at a lower tillage cost/ha than the former.

Sowing

Development of sowing equipment for use in field trials aimed at evaluating various means of improving row crop emergence is continuing.

FOOD STORAGE

Controlled Atmosphere Storage

An open flame controlled atmosphere generator developed at the Glenfield A.E.C. and now in commercial production, is being used in cool stores throughout Australia. Overseas sales are also being made.

Ethylene Scrubber

In order to store bananas successfully ethylene generated by the fruit must be removed. An effective ethylene scrubber has been made and is being tested to establish the design parameters for commercial units.

Grain Drying

Data obtained in the previous year's laboratory experiments concerned with establishing a maximum safe drying temperature for grain sorghum has been analysed and published. Drying temperatures up to 135°C did not adversely affect the feeding quality of the grain.

Grain Aeration

The practical elimination of insect infestation in silo-stored grain has been achieved under semicoastal conditions by intermittent aeration with cold air. The grain, loaded in 1971, has remained in good condition and the trial will be continued in 1973-4.

EQUIPMENT FOR AGRICULTURAL RESEARCH

Rice Seeder

An improved design of cone seeder with better metering performance than that of previous units is now being manufactured for use at Yanco A.C.R.C.

Weighing Lysimeters

Two weighing lysimeters are being manufactured for installation at Wagga A.R.I. Testing of one completed machine revealed that the weighing mechanism was unstable and modifications are being made to correct this fault.

Temperature Controlled Glasshouses

Design work on temperature control equipment for six and three room glasshouses at Yanco A.C.R.C. and Narara H.R.S. has been completed.

SOCIAL RESEARCH

ECONOMICS AND MARKETING

Farm Situation

Revaluation: Compared with what returns would otherwise have been, it is estimated that the 7.05 per cent revaluation of the \$A reduced returns to the rural industries of N.S.W. by between \$46.8 million and \$49.1 million in a full year based on 1972-3 sales. A further \$4 million is expected to be lost on contractual arrangements.

Agricultural situation 1972-3: The increased income of 1972-3 is probably attributable mainly to relative short-term influences. The continued pressure of costs on incomes and the necessity of heavy investment programmes together with likely output price reductions in the future suggest the continued need for adjustment in farm organization and management, and for improvements in productivity.

Structure of Farm Businesses

Lower Hunter: A sample survey of 120 farm businesses indicated a diversity of farm structures in the region. A third of the businesses did not provide a full-time occupation for their operators, two-fifths had off-farm employment, and nearly a third made more income from their off-farm jobs than from their farm businesses.

Cockburn and Nundle Shires: A study of landholders with properties for sale was undertaken to study adjustments in agriculture and the role of the land market. The study demonstrated a high potential mobility among owner operators in agriculture. Mobility appears to be facilitated by the availability of off-farm jobs, satisfactory land prices and opportunities for retraining.

Rural Labour

Regression analysis suggests that about 1.2 people in the rural urban sector are required to support each person in the rural farm sector. Further work is underway to assess the principal factors which influence the demand and supply of self-employed, family and hired farm workers in the rural farm sector.

Implications for Australian Farmers of a 35-Hour Week

The most likely effect of the introduction of a 35-hour working week into Australian rural industries would be to reduce the aggregate net return to entrepreneurial management and risk, in 1968-9 terms, by approximately 30 per cent in the short run and 44 per cent in the long run. Aggregate net farm incomes would fall by about 17 per cent in the short run and 25 per cent in the long run. The number of self-employed farmers would fall by about 5 per cent and the number of hired farm labourers required would fall by about 8 per cent after the 35-hour week was introduced and complete adjustment to it occurred. At 1968-9 levels it is estimated that net farm income per self-employed farmer would fall about 20 per cent in the longer run in a similar year.

Farm Record Analysis and Enterprise Budgeting

A large number of studies have been undertaken in different areas of the State on the collection and analysis of data relating to the physical and financial performance of farm firms. Information relating to the costs and returns for particular activities, the comparative performance of alternative whole farm programmes, the effects of price and product variations on farm returns and the likely implications of new activities on farm organization and performance have met a large demand from the farm public. Budgets to evaluate present and potential enterprises on irrigated holdings in the Macquarie Valley area have been used to provide research priorities and guidelines to personnel at Trangie A.R.S.

Farm Plans for Southern Wheat Belt

Linear programming procedures were used to assess optimum long-term farm plans for different types of farms in the Wagga area. Discussion of these farm plans with local farmers indicated that farmers would not adopt the plans because they took no account of seasonal variability, they allowed no flexibility for actions in less than "normal" years and they were judged to be too risky. The procedures are being modified to incorporate farmers' preferences for risk aversion and farm flexibility.

Extension in Farm Business Management

A report was prepared on the state of the arts and the application of farm business management extension in Australia. The report recommended a greater degree of co-operation and co-ordination in the collection and presentation of farm business management information by the various government and private institutions involved in farm management extension. It was recommended that greater priority be given to analysing the implications of changes in technology and prices on the whole farm business, the supply of commodity information to extension officers and farmers, and to education in decision and planning aids.

Farmer Objectives

Considerable research has been undertaken to assess the socioeconomic motivations of farmers in farm business management and to determine the relative effects of different farmer objectives and taxation structures and rules on farm supply response to different price situations. Preliminary results suggest that the traditional objective of profit maximization is inadequate as an explanation of individual farm supply response in N.S.W.

EXTENSION

Evaluation of Agricultural Publications

Three government and two commercial farming magazines were evaluated by group interviews with farmers on the North Coast and in the Central West. The Department's *Dairy Topics* was rated highly.

Information and Changes in Farm Practices

Analysis of the information section of surveys in four shires showed that about one quarter to a half of farmers had had personal contact with the Department during the preceding year. Farmers who had more contact tended to have a higher than average gross farm income, a higher level of education and were more active in community organizations.

Use of mass media differed between shires but was generally high. Low use of one media form was predictive of low use of another.

Communication and Distribution of Work Time in Agricultural Extension

Results of recording by extension officers showed that they spend nearly half their time in direct extension, a quarter in administration, regulation or service to government departments and one sixth in study and information collection.

Questionnaire responses have indicated difficulties in communication between groups of officers. The relationships of these responses to factors such as experience of the officers, distribution of work time and an extension attitude scale, is being tested.

4. EXTENSION

TRAINING OF EXTENSION OFFICERS

TRAINING SYSTEMS

Committee on In-Service Training for Extension

The committee completed its examination of training methods and procedures and in its report to the Director-General recommended important changes in the approach to extension staff development.

The committee's philosophy was that changes were necessary, that all desirable changes could not be made at once because of resource limitations, and that changes were unlikely to be effective unless they helped satisfy needs recognized by extension officers.

Its approach and recommendations were consistent with the Public Service Board's policy statement of November, 1972, on the development of human resources. Recommendations were based on assumptions that training programmes should be:

- Sequential so that appropriate training was provided at appropriate stages of an officer's career.
- Cumulative in effect, each stage providing a basis for the next.
- Continuous throughout the officer's service.
- Related to the needs of officers and to the objectives of the Department.
- Evaluated in terms of predetermined objectives.

Regional Training

In-service development of officers in training continued in all regions. Under the guidance of the regional supervisor young officers were placed with experienced officers of other subject matter divisions as well as their own. The programme gave an officer a minimum of six months' intensive training in one or more regions.

Training Programmes

Increased emphasis was given by regional economists to the training of extension officers in farm business management. This was done by involving them in studies and projects, by participation in extension teams, and in organized regional training sessions.

Development of the first stage of a three-stage programme for officers of the Division of Dairying was completed. The programme is flexible to meet divisional and individual needs, includes checklists, and encourages the officer to participate in the planning of his own training, and to assess his development.

Training records introduced by the Division of Horticulture proved of benefit in highlighting specific areas of need in the training of individual officers.

Training of officers of the Sheep and Wool Section of the Division of Animal Industry was varied to provide for location of new appointees at a regional headquarters for 3 months for exposure to an extension environment before location on a research station. It was also decided to provide training, in an officer's second year of service, on commercial properties, and an officer commenced such training for the first time.

SCHOOLS AND COURSES

Extension Methods

The traditional extension service/methods school of ten days' duration was not held. In line with a recommendation of the Committee on In-Service Training for Extension it was decided to replace it with at least two schools of 5 days' duration, held in country centres. Arrangements were made for the first two such schools.

An extension methods training workshop was held for selected Division of Extension Services officers to consider and formulate training programmes on a number of extension methods subjects. The need to develop "teams" of resource people to specialise in specific training areas was also reviewed. From workshop discussions it became apparent that the Division would need to invest more time in training trainers than in the past.

Regional workshops in extension counselling, working with rural groups, and photography were held in the Northern, North Western and South Western Regions.

Five reading skills improvement courses were conducted over 5-day periods with one and one-half hours instruction daily.

A Division of Horticulture officer attended a short-term rural extension course at the University of Queensland.

Irrigation

Three fruit officers in training completed the 1972 irrigation certificate course at Yanco Agricultural College and Research Centre, and two enrolled for the 1973 course.

Foot and Mouth Disease

Two schools were held to train veterinary officers and veterinary inspectors in the diagnosis and eradication of foot and mouth disease. Simulated outbreaks involved the setting up and running of emergency headquarters, and visits to farms, saleyards, abattoirs, dairy factories and artificial breeding centres for training purposes.

Mastitis

Three seminars held for dairy officers, veterinary officers and veterinary inspectors were based on the results of a 3-year mastitis control programme.

Other Schools and Courses

Livestock officers (dairy cattle), herd organizers and herd recorders received training in the use of optical character reading stationery.

Thirty-one veterinary officers and veterinary inspectors attended a refresher course in parasitology. Two attended a course in blood pathology.

STUDY TOURS AND CONFERENCES

Australian Agricultural Extension Conference

The third Australian Agricultural Extension Conference was held at Glenormiston Agricultural College, Noorat, Victoria. The conference examined agricultural extension in relation to the current period of economic, social and technological adjustment in the rural community. All States, the Commonwealth Department of Primary Industry and CSIRO were represented.

Invited and contributed papers in the following subject areas were reviewed and discussed:

- Reconciliation of needs as seen by farmers with priorities as defined by extension workers.
- Development of interdependence between extension and research.
- The audience for extension.
- Extension in farm business management.
- Extension for rural adjustment.

Dairy Farm Management

The Division of Dairying was largely responsible for the organization of a dairy farm management conference under the auspices of the Standing Committee on Agriculture, in July, 1972. Conference objectives were to:

- Review and update knowledge in dairyfarm management.
- Produce a handbook for extension and research workers throughout the Commonwealth.

The handbook was published.

POST-GRADUATE STUDY

Two officers of the Division of Extension Services continued external studies for higher degrees at the University of New England.

Three officers of the Division of Marketing and Economics were granted study leave for post-graduate studies at the University of New England (2) and the University of Sydney.

Nine officers completed the 1972 course for the Hawkesbury Diploma in Rural Extension and eight extension officers enrolled in the 1973 course.

NEW DEVELOPMENTS

Rural Adjustment

The spectacular recovery of primary industries from the recession of the past 4 years masked the problems which gave rise to the formation of Inter-departmental Rural Adjustment Committees, so that their task of selecting meaningful objectives became more complex. Some regional committees investigated the distribution of school leavers, and showed that youth was far better informed on education and job opportunities than was generally conceded.

Hobby Farms

The rate of subdivision of rural land into hobby farms of 3 to 30 hectares increased, particularly in coastal areas and around the larger inland centres of population.

Hobby farmers increase the workload of extension officers and divert resources from full-time farmers.

The volume of enquiries from the area surrounding the Australian Capital Territory became so great that it was necessary to establish an additional district agronomist position, at Yass.

Officers of the South Coast and Tablelands region produced a special publication, *Small Area Farming*, to assist in meeting hobby farmer requests for information.

Extension Emphasis

The improved economic situation in the sheep industry led to significant changes in emphasis. Wool producers were no longer interested in developing alternative enterprises, with emphasis on beef cattle and crops. Their primary concerns were with pastures and husbandry.

Favourable markets for wheat, oilseeds and other grains, and continuing irrigation development, resulted in increased extension emphasis in these areas.

Marketing

Economists placed greater emphasis upon the collection, interpretation and dissemination of market intelligence information throughout the State.

The commencement of publication of a monthly *Commodity Bulletin* in July, 1972, was significant. The bulletin presents commodity outlook information for use by economists and extension officers.

Farm Business Management

A significant development, resulting from a report on farm management extension presented to Standing Committee on Agriculture, was an interstate meeting of farm management and extension specialists. This led to the establishment of farm management extension liaison men in each state department, and improved co-ordination of farm management extension activities between departments.

ACTIVITIES OF EXTENSION OFFICERS

Sheep and Wool

The improved economic situation of the sheep industry led to a significant fall in the number of casual requests for sheep management advice, enabling officers to concentrate more on extension projects.

They made 1,431 farm visits, addressed 141 meetings and field-days, and undertook 132 demonstration projects. They issued 301 press items, made 191 broadcasts and 13 telecasts.

Beef Cattle

In a period of continued expansion of the industry, officers were particularly concerned with newcomers to the industry, and with lot feeding.

Farm visits totalled 1,499. Officers participated in 53 schools, addressed 97 meetings and 124 field days. They undertook 14 demonstration projects, issued 148 press items, made 244 broadcasts and 22 telecasts.

Pigs

Following the report of a study group on the feasibility of implementing a national pig grading carcass system, officers undertook the measurement of about 10,000 carcasses. It is expected that the information obtained, with that from similar surveys in other states, will lead to the introduction of a carcass measuring service and consequent improvement in carcass quality.

Officers made 1,875 farm visits, addressed 162 meetings, conducted 17 schools and 55 field-days, and undertook 23 demonstration projects. They issued 145 press items, made 153 broadcasts and 7 telecasts.

Poultry

Because of the contraction of the egg and broiler industries into fewer but larger farms, extension activities were reoriented, with greater use of field trials to demonstrate the application of research results.

Officers made 915 farm visits, addressed 22 meetings, and conducted 11 field-days and 8 demonstration projects. They issued 88 press items and made 63 broadcasts.

Apiculture

Farm visits totalled 850. Officers addressed 45 meetings and conducted 9 demonstrations. They issued 28 press items and made 48 broadcasts.

Animal Health

Veterinary officers addressed 77 meetings and undertook 16 field day demonstrations. They issued 285 press items, made 106 broadcasts and 2 telecasts, and made 67 contributions to newsletters.

Horticulture

Greater attention was paid to bulk handling. There was more interest in the mechanical harvesting of fruit as a means of reducing production costs, and because of increased difficulty in obtaining casual labour in most fruitgrowing areas.

Extension officers made 6,190 farm visits, and contributed to 273 meetings, 22 workshops and 9 schools. They took part in 88 field-days and conducted 86 trials and demonstrations.

Economics

Although the involvement of economists in direct advisory work with individual producers is limited, they made many farm visits in the course of research and investigational projects.

They participated in more than 100 meetings and field-days, and addressed 112 farmer groups.

Agronomy

With buoyancy in the beef and wool industries and some relaxation of wheat delivery quotas, more attention was given to winter cereals, pasture improvement and coarse grains.

Officers addressed 290 meetings, undertook 558 experiments and conducted 148 demonstrations. They issued 1,056 press items, and made 1,131 broadcasts and 52 telecasts.

Mechanization

The work of machinery officers included attention to grain drying, electric fencing, grain sowing, mechanical harvesting of fruit and vegetables, irrigation techniques, livestock feeding and controlled atmosphere storage.

They made 1,227 farm visits, participated in 78 meetings, and were involved in 82-field days and demonstrations, and in 342 schools. They issued 37 press items, made 167 broadcasts and 14 telecasts, and contributed 38 items to newsletters.

Dairying

Officers made 5,982 farm visits, addressed 161 field-days and 420 meetings and conducted 30 trials and demonstrations. They issued 304 press items, made 185 broadcasts and 6 telecasts and conducted 78 tutorial classes for factory operatives. Additionally they made 2,399 factory visits.

Entomology

Entomologists are not primarily extension officers, but in an extension support role made 334 farm visits and addressed 31 field-days and meetings.

Biology

Plant pathologists are not primarily extension officers but in an extension support role made 144 farm visits and addressed 2 field-days and meetings.

Home Gardens

Home gardens enquiry officers in Sydney serviced 13,694 requests for information, and addressed a number of garden clubs and horticultural societies. They also conducted 3 gardening schools in country centres.

Botanists addressed meetings of societies on topics of interest to home gardeners, and conducted educational tours of the Royal Botanic Gardens.

EXTENSION PROGRAMMES

Extension programmes reflected the changing situation in agriculture, which demanded that information to meet the needs of primary producers be continually obtained, assessed and adapted for their use.

Programmes showed an increased awareness of the need to use group extension outlets for the dissemination of information.

The trend noticed last year for officers to develop a team approach to extension planning became more evident in all regions.

Division of Extension Services

Objectives included: extension officer training; further development of programme planning; group extension including greater use of informal groups; extension research and evaluation; liaison with research and agribusiness; provision of audio visual aids; development of media channels; public affairs programmes concerned with rural adjustment; improvements to departmental publications; further development and improvement of regional publications.

Division of Animal Industry

Sheep and wool section: Objectives included: improvement of lambing percentages and lamb survival; improved nutrition of breeding ewes; use of lucerne for sheep; blowfly control by mulesing at marking, and by efficient jetting; development of minimum care sheep; evaluation of plastic coats; promotion of objective measurement; use of modern methods in wool preparation.

Beef cattle section: Objectives included: use and development of performance recording systems; improved identification and handling systems; adoption of controlled mating; development of intensive feeding systems; drought feeding and management strategies; education of new producers.

Pig section: Objectives included: economic feeding of high protein diets; improvement of housing standards; increased sow productivity; performance selection of breeding stock.

Poultry section: Objectives included: encouragement of record keeping; improved broiler housing design and operation; greater mechanization; evaluation of forced moulting techniques; coolroom egg storage; evaluation of restricted feeding of replacement pullets; evaluation of temperature control methods for housed layers; evaluation of bulk handling of eggs.

Veterinary section: Objectives included: control of infectious scours in pigs; control of clostridial diseases in sheep and cattle; correct use of livestock vaccines; mastitis control; improved beef cattle calving percentages; cattle brucellosis eradication campaign; copper deficiency in cattle; farmer education in hydatid control; control of worm parasites in cattle; control of external parasites of sheep.

Division of Dairying

Objectives included: upgrading the quality of milk, cream and dairy products; herd improvement; mastitis control; machine efficiency and milking management.

Division of Horticulture

Objectives included: use of supplementary irrigation; improved nutritional practices; improved fruit quality; use of mechanical aids to harvesting, hedging and trellising.

Division of Plant Industry

Objectives included: pasture improvement; fodder conservation; high moisture grain storage; coarse grains production; oilseeds production; increased lucerne area; fertilizer use; irrigation design and application.

Division of Marketing and Economics

Objectives included: provision of regional economic information on farm production possibilities, farm strategies and techniques; dissemination of markets information.

Division of Research Services

Objectives included: grain harvesting, cleaning and handling; grain drying; sowing of summer crops; potato mechanization and storage; electric fencing; controlled environments; high pressure irrigation.

EXTENSION THROUGH MASS MEDIA PUBLICATIONS

Agricultural Gazette of N.S.W.: (2-monthly; quarto; 64 pages). Six issues were published, all but one being published in the nominal month of issue, with an average lateness of 22 days. The research news section totalled 32 pages, an average of 5 per issue, with a total of 60 items. Distribution remained fairly constant at 29,700 copies.

Dairy Topics: (Quarterly; octavo; 32–48 pages). Four issues were published. Copies were forwarded to all registered dairymen in New South Wales. Distribution was about 9,000 copies.

Poultry Notes: (Quarterly; quarto; average 15 pages). Four issues were published. Distribution was 3,629 copies.

Veterinary Notes: (Quarterly; quarto; average 32 pages). Three issues were published, with a distribution of 460 copies.

Commodity Bulletin: Monthly. Eleven issues were published by the Division of Marketing and Economics, with a distribution of four hundred copies.

Advisory bulletins: The list of advisory bulletins processed in the editorial section totalled 1,464. Of these, 78 were in various stages of revision prior to submission to the printer.

Printing of 111 bulletins was requisitioned during the year and a total of 127 completed bulletins were delivered by the printer. At 30th June, 72 bulletins were still with the printer.

Science Bulletins: Two science bulletins were delivered by the printer.

Annual Report of the Department of Agriculture: The annual report of the Department of Agriculture for 1971–2 was produced for tabling in Parliament on 24th October, 1972. Parliament on that date ordered it for printing. The printed report was delivered on 19th March, 1973.

Miscellaneous: A total of fifty-three other jobs, including handbooks, authors' reprints, covers, reports and brochures were requisitioned for printing. Fifty-two jobs were delivered by the printer.

A booklet entitled *Small Area Farming* was produced by officers of the South Coast and Tablelands region.

Sales publications: The book *Weeds* (2nd edition) went out of print in August, 1972. *Bees and Honey* went out of print in May, 1973.

Leaflet distribution: The number of leaflets distributed during the year was 726,312, of which some 605,980 were supplied to regional offices, and 88,492 in response to public enquiries in Sydney.

Regional publications: The number of regional publications produced during the year increased. Much of the increase was attributable to greater numbers of newsletters, some of which are concerned with specific industries (beef cattle, pigs, poultry, fruit, dairying and wheat). Others covered many aspects of primary production. Most newsletters were mailed directly to farmers who applied for them.

Publications and enquiry service: The publications and enquiry section of the Division of Extension Services handled a total of 29,296 requests for information. These comprised in-person requests 11,963, telephone 9,172, urban post 2,657, and rural post 5,504.

RADIO AND TELEVISION

Radio

More than 10,500 broadcasts were made from 3,380 tapes recorded. This illustrates that extension officers generally sustained their use of this medium. Fifty-six interviews were recorded by the Extension Officer (Radio) with head office specialists for regional release, or use by the Australian Broadcasting Commission and Macquarie networks.

Seventeen tapes were recorded by the Senior Extension Officer (Women's Service) for regional release. In addition, she recorded nine subject matter series, each of six tapes, for use in national and regional programmes.

Changes occurred in radio communication patterns. For example, a weekly half-hour programme entitled "Radio Rural" was commenced by the Western Region at the request of the management of radio stations 2BS Bathurst and 2MG Mudgee. A favourable reaction led to its placement in a very favourable time-slot. Previously the Region provided a wide range of tapes for use at sporadic intervals during the day. It was considered that the weekly feature had a greater impact than the sporadic tapes. Similar changes to radio usage occurred in several other regions.

Television

Ninety-two television programmes were prepared and telecast. These were confined largely to four regions where station managements continued to support agricultural television programmes. In all other regions, agricultural information was used as inserts into news programmes. These included special interviews with extension staff on topics of current agricultural interest.

In the North Coast Region, the regional publicity officer co-operated with Station NRN 11 Coffs Harbour to produce five 12-minute colour feature films dealing with agriculture on the North Coast, for promotional use nationally and overseas. They will be used locally when colour television is introduced to Australia.

In the South Western Region, the videotape "Locust '71", made from film clips during the 1971 locust plague in South Western New South Wales, was made into a 16 mm film. This was then used in preparation for the 1972 locust plague control campaigns in north western and south western areas.

PRESS

Some 2,012 original press items were released to newspapers, radio and television stations through regional offices. Another 78 news items were released from head office, and 32 statements dealing with educational projects were prepared by the Senior Extension Officer (Women's Service).

Interesting changes occurred in extension officers' use of country press. In the mid-Western Region, weekly columns prepared or edited by district agronomists featured in all regional newspapers. In addition to columns established earlier in newspapers at Cowra and Parkes, this type of feature was accepted by newspapers at West Wyalong, Condobolin and Lake Cargelligo.

Effectiveness of contact with farmers was evaluated by a survey of landholders in the Waugoola Shire, based on Cowra. Of the sample interviewed, 96 per cent received the local newspaper and 90 per cent read the column regularly, commenting favourably on the relevance of the material presented.

Similarly, weekly columns were commenced by extension officers in a number of other regions.

GROUP EXTENSION

AGRICULTURAL BUREAU OF NEW SOUTH WALES

In 1972-3 there were ninety branches of the Agricultural Bureau affiliated with the Executive Council. One new branch was formed during the year.

At the 30th June, 1973, the Bureau had 2,642 affiliated members.

State Executive Council

Eight Agricultural Bureau regions were represented on the Executive Council, which held four meetings during the year.

The Executive Council spent much time in developing long- and short-term objectives for the future of the Bureau. Council approved a programme of needs definition meetings amongst all branches. The first phase of this programme was completed with all branches in the North Coast, North Western and Western Regions. As a result of these meetings, activities were designed to meet the needs of branch members.

State Conference

The forty-eighth State Conference of the Bureau was held at the Mitchell College of Advanced Education, Bathurst, from 10th-13th July, 1972. It was officially opened by Mr E. A. B. Phillips, the principal of the college. One hundred and twenty delegates, representing forty-seven branches, attended. The programme dealt with planning for the future of agriculture, marketing, and regional development.

Beef Cattle Breeders Competition 1972-3

The Rural Bank of New South Wales and the Department of Agriculture again co-operated with the Agricultural Bureau in conducting the Beef Cattle Breeders Competition. This year 136 entries were received.

Branch Activities

Through its various branches and councils, the Agricultural Bureau of New South Wales was active in the promotion of educational programmes comprising schools, courses, lectures, field-days and discussions for farmers. Total attendance at the 297 functions recorded was 10,049.

OTHER GROUPS

Many organizations were associated with the promotion, sponsorship, or organization of a wide variety of group extension activities. Among these were the United Farmers and Woolgrowers Association; Graziers Association; Australian Society of Animal Production; Service organizations such as Apex and Lions; Show Societies; Rural Youth; Dairy Farmers Associations; Co-operatives; and research and extension councils.

Commercial firms continued to be active in the promotion of educational functions, individually or in co-operation with officers of the Department.

The trend noted last year for extension officers to make greater use of informal discussion groups intensified in 1972-3. These groups proved highly beneficial to participating farmers and to extension officers.

GROUP EXTENSION ACTIVITIES

The following table summarizes group extension activities in 1972-3:

	<i>Number Held</i>	<i>Total Attendance</i>
Schools, Symposia Conferences, Seminars	167	6,653
Field-days	457	22,150
Meetings, including Discussion Groups	845	19,597
<i>Totals</i>	1,469	48,400

In all regions, the most numerous and best attended activities were those dealing with the production of beef, but as was the case last year, activities on pig production continued to attract widespread interest. In tablelands areas many activities were held on pasture production, reflecting the increased interest in sheep-raising. In coastal areas, activities dealing with subjects on dairying continued to be prominent.

A number of functions, particularly in coastal areas, related to aspects of rural adjustment. They aroused widespread interest and in most cases attracted large audiences.

The Women's Extension Service assisted in the arrangement of eighteen one-day schools for rural women.

SERVICES FOR EXTENSION OFFICERS

EXTENSION/RESEARCH LIAISON

In Regions

Regional supervisors reported increased action in the development of better liaison between extension and research. The following comments typify trends in all regions:

In the North Western region a marked improvement in liaison was noted, due to efforts by both extension and research officers. The appointment of a Regional Director of Research improved liaison at all levels, and liaison with industry also improved.

In the South Western Region, a number of consultations followed the appointment of a Regional Director of Research, to develop closer liaison. These led to a reorganization of the annual agronomy conference at Yanco Agricultural College and Research Centre to better serve the needs of extension and research officers.

Analysis of a liaison survey in the Northern and North Western Regions was completed. Results were presented to a number of seminars, and are in preparation for publication.

Research Liaison Officers (Science Writing)

Officers assisted research workers in the preparation of scientific material for publication in science journals, or in a form suitable for publication for primary producers.

They compiled the research news section of the *Agricultural Gazette*, and co-operated in the organization and programme of a school on research paper writing.

AUDIO VISUAL AIDS

Display Artist/Design Services

The work of artists, with that of photographers in the Audio Visual Aids Section, became more strongly oriented to editorial needs. Greater stress was placed on modern layout and design, with the use of up-to-date professional photographs, to improve the quality of departmental publications.

A special symbol depicting agriculture was designed for departmental use.

Special weeds plates for colour reproduction, and cover designs for departmental publications, figured prominently in activities.

Displays were prepared for the Royal Easter Show, the Orange National Field Days and the annual poultry field-day at Hawkesbury Agricultural College.

Photographic Services

Special assignments undertaken included: a film "It's a Full-time Job" on the Poultry Section's farm management system; colour photographs of material seized by the Animal Quarantine Service; photographs on all aspects of cattle tick control; photographs of pigmeat dishes prepared at East Sydney Technical College, for the Pig Research Committee; and close-up photographs of native legumes and pastures.

Film Library

Some 363 films were loaned to country offices, universities, colleges and high schools.

Equipment and Materials

Commonwealth Extension Services Grant: Items costing more than \$16,000 were purchased with funds made available from this source.

Items acquired included: portable blackboards; portable public address systems; 35 mm cameras and films; 16 mm films; a photographic enlarger; portable electronic calculators; art materials.

Additionally, two vehicles were purchased for use by officers in training.

State funds: Items obtained at a total cost of about \$3,000 included electric duplicators; an electric stapler; an add listing machine; dictation units.

5. EDUCATION

The administration of five agricultural colleges — at Richmond (Hawkesbury), Orange, Wagga, Yanco and Paterson (C. B. Alexander) continued to be one of the major functions of the Department.

ACHIEVEMENTS AND POLICY CHANGES

RECORD ENROLMENTS

It has been Government policy for many years to expand on and improve the standard of agricultural education in New South Wales — education directed towards the overall promotion of the efficiency and productivity of rural enterprises, either directly by the educational training of farmers and prospective farmers, or indirectly by educating the technologists whose function it is, or will be, to service the primary producer.

As a result of this policy facilities have continued to expand to the extent that total enrolments in 1973 reached a record level of 667, compared with 575 in 1972 and 516 in 1971.

Further expansion was made in respect of teaching and residential facilities to increase the student intake capacity to 900 in 1974.

CAPITAL WORKS PROGRAMMES

Expenditure from funds provided under the States' Grants (Advanced Education) Act and the States' Grants (Technical Training) Act amounted to \$3,041,284 compared with \$1,584,284 in the previous year. Details of expenditure on individual projects are included in appendix I (ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1972-3).

The total value of projects completed or almost completed at the five agricultural colleges was in excess of \$5.4 million. Major works comprised: food technology complex, administration building, student accommodation block, apiary building and ancillary buildings at Hawkesbury Agricultural College; student accommodation block, kitchen and dining room, animal and plant science laboratories and dairy buildings at Wagga; administration building, kitchen-dining room-union building, lecturing-laboratory-library complex, student accommodation blocks, staff flats, essential services, sporting facilities and ancillary buildings at Orange; and irrigation teaching laboratory, library building and ancillary buildings at Yanco.

Works under construction had a combined value in excess of \$1.6 million. The major projects involved were: food processing building at Hawkesbury; single officers' accommodation block at C. B. Alexander; and staff cottage complex at Orange.

Working drawings and documentation were completed or almost completed on approved new projects with a combined estimated value of \$2 million. Major projects comprised: field services building, renovation of student accommodation, union-library extensions and piggery at Hawkesbury; additions to administration building and maintenance complex at Wagga; renovation of student accommodation, hydraulics laboratory and new water supply at Yanco; and teaching complex and essential services at C. B. Alexander.

ORANGE AGRICULTURAL COLLEGE

Construction work to a total value of \$2.9 million became sufficiently advanced to enable Orange Agricultural College to enrol its first students in July, 1973. The initial students were selected in accord with a points-score system which took into account industry experience and motivation in addition to academic achievement.

The college was gazetted under the provisions of the New South Wales Higher Education Act as a college of advanced education from 30th March, 1973. Planning was completed for the offering of a 2-year diploma course in farm management for men and women students intending to return to the rural industries as farmers or employed managers.

INSTITUTE OF RURAL STUDIES

A bill to constitute the Institute of Rural Studies was introduced into Parliament. The main functions of the Institute will be to plan for the development of existing courses in agriculture and to investigate the need for further courses; to foster the co-ordination, development and improvement of agricultural education in New South Wales; and to foster the co-ordination of the education research and extension services of the Department to ensure the economic and efficient use of these services in the interest of agricultural education.

The Institute of Rural Studies will replace the Committee of Advice on Rural Studies which was established in 1967 to assume responsibility for the co-ordination and planning of activities in the field of post-secondary agricultural education other than in the universities; planning for the establishment of an institute of rural studies; and undertaking the duties previously the function of the Agricultural Colleges Advisory Committee.

A board of studies was appointed to plan and co-ordinate the development of certificate courses in agriculture and specialist sub-tertiary courses in irrigation and cattle husbandry at the Yanco and C. B. Alexander Agricultural Colleges. Investigations were commenced into proposals to introduce additional specialized courses in animal husbandry, intensive row-crop production and intensive vegetable/viticultural production.

In recognition of the need for continuing farmer education, a steering committee on education for practising farmers was appointed to analyse and collate the information available on the needs and avenues for training and to formulate guidelines for the establishment of appropriate courses and programmes.

FEMALE STUDENTS

Admitted for the first time in 1972, the number of women students attending agricultural courses increased from thirty-eight to fifty-one and from forty-eight to seventy-six, in first year and all years, respectively.

Considerable progress was made in plans to increase on-campus accommodation for women students. A complete block was made available at Wagga; construction of a new block at Hawkesbury was almost completed; plans and specifications for a new block at C. B. Alexander were finalized.

COLLEGES OF ADVANCED EDUCATION

COURSES

The initial group of students who attended diploma courses at Hawkesbury and Wagga at advanced education level graduated at the end of 1972.

The restructuring of courses to meet vocational needs continued and the accent on personal involvement in practical field activities has diminished. Increased emphasis has been placed on the provision of practical demonstrations, student projects and assignments. All courses have now been converted to a unit system and student assessment to a grade point average basis.

The conversion of Hawkesbury and Wagga Colleges to the two-semester academic year has now been fully implemented, and a decision was taken for Orange College to adopt this system.

Agriculture

A total of fifty-seven students attempted the final examinations at Hawkesbury Agricultural College at the end of 1972. Of these thirty-six were awarded diplomas, eight with second class honours.

At Wagga Agricultural College, thirty-eight students out of thirty-nine graduated at the end of 1972. One with first class honours and two with second class honours.

Dairy Technology

The first nine students to complete the restructured 3-year course will attempt their final examinations at the end of 1973.

Food Technology

The first nineteen students to complete the restructured 3-year course will attempt their final examinations at the end of 1973.

Poultry Technology

The restructured 3-year programme was commenced in 1973 with an intake of three students. The three students who enrolled in 1972 have transferred to the second year of the 3-year programme. One student undertaking the 2-year course will attempt the final examination in 1973.

Rural Extension

The post-diploma course in rural extension, first introduced in 1970, continued to attract Australia-wide interest and representation.

A total of eighteen students successfully completed their 1972 programmes bringing to forty-three the number of students who have now received training in rural extension.

STUDENT ENROLMENTS

The 1973 enrolment of first year students in the 6 diploma courses at Hawkesbury and Wagga Agricultural Colleges was 251 as compared with 207 in 1972. Total enrolment at these colleges increased from 431 in 1972 to 495 in 1973.

Students enrolled in the first year of the agriculture diploma course in 1973 at Hawkesbury Agricultural College increased from 78 to 93 whilst total students in all years decreased from 177 to 176. At Wagga Agricultural College, first year enrolments increased from 64 to 75 and total student enrolments from 146 to 156.

At Hawkesbury Agricultural College enrolments in the diploma course in food technology increased from thirty-three to forty-three and total enrolments from fifty-one to eighty-three. Enrolments in the dairy technology course decreased from 17 to 16 whereas total student numbers increased from twenty-nine to thirty-five. Students enrolled in the poultry technology course decreased from seven to four and a total of nine students were enrolled.

Enrolments in the one-year post-diploma course in rural extension increased from eighteen in 1972 to twenty in 1973.

ASSISTED STUDENTS

Of the 339 students enrolled at Hawkesbury Agricultural College, 218 received some form of financial assistance. All students in the rural extension course were sponsored and other sponsorships were as follows:

- Agriculture diploma course — advanced education scholarships forty-six, State bursaries and scholarships five, teacher traineeships forty-five, public service traineeships four, industry and private scholarships twelve, repatriation scholarships four and Colombo Plan two.
- Dairy technology diploma course — advanced education scholarships seven, industry scholarships nineteen, overseas sponsorships three, and dairy apprenticeships two.
- Food technology diploma course — advanced education scholarships thirty-one, industry scholarships twenty-eight, bursaries four, repatriation scholarships one and Colombo Plan four.
- Poultry technology diploma course — advanced education scholarships one, and industry scholarships six.

At Wagga Agricultural College, of a total enrolment of 156, 86 students received some form of assistance. These comprised: advanced education scholarships 33, State bursaries and scholarships 4, teacher traineeships 42, private and industry endowments 6 and repatriation scholarships 1.

COLLEGE UNIONS

The Hawkesbury and Wagga Agricultural College Unions continued to operate successfully in controlling the cultural, social, recreational and sporting activities of the colleges.

SHORT TERM SCHOOLS

As in previous years the facilities of both colleges were utilized during vacation periods for the conduct of industry and extension schools, conferences and refresher courses. Included in these functions were: an apiary school, smallgoods workshop, food plant foreman workshop, farm managers' conference, beef cattle officers' conference and refresher courses for stud management and pig producers at Hawkesbury Agricultural College and the annual school for rural youth at Wagga Agricultural College, together with a refresher course in soil science for teachers of agriculture attached to the Department of Education.

FARM AND FACTORY SECTIONS

There was a significant reduction in student involvement in the day-to-day management of the various sections of the colleges and an increased emphasis on the provision of demonstrations and the development of student projects.

Action was commenced to programme a restructuring of the operations of the dairy products factory. Discussions were held with officers of the Dairy Industry Authority aimed at the scaling down of the commercial operations to provide for increased emphasis on the staging of practical demonstrations and the oversight of student projects.

At Hawkesbury Agricultural College, the value of sales from the dairy products factory increased from \$395,353 in 1971-2 to \$440,720 in 1972-3. Total sheep numbers rose from 1,094 to 1,101 and the value of wool sales remained at a constant level. Beef and dairy cattle numbers rose from 477 to 550 and 169 to 188, respectively, and total pig numbers from 337 to 366.

The number of sheep at Wagga Agricultural College increased from 3,295 to 3,615, and the dairy herd from 152 to 156. Beef cattle increased from 223 to 275, whilst horses decreased from 70 to 66.

Beef cattle at Orange Agricultural College totalled 310 at 30th June, 1973.

CERTIFICATE COLLEGES

COURSES

Certificate level courses in agriculture were conducted at Yanco and C. B. Alexander Colleges. Advanced certificate courses were presented in irrigation at Yanco and in cattle husbandry at C. B. Alexander College.

Agriculture

At Yanco thirty-nine students attempted the final examinations at the end of 1973 and thirty-one were awarded certificates.

At C. B. Alexander College, forty-three of the fifty-eight students who attempted the final examination were successful.

Interest in these courses continued to rise, thereby justifying the decision to introduce the practically-oriented form of intensive training for those intending to return to the land to take up the management of properties. In addition, Yanco students were encouraged into undertaking further education, including university training.

Irrigation

Certificates were awarded to nine of the eleven students who attempted the final examinations. The completion of new teaching facilities prior to the commencement of the 1973 college year aided materially in the provision of this course.

Cattle Husbandry

At the conclusion of the 1972 course, twenty-six students attempted the final examinations and twenty-one were successful in gaining certificates.

STUDENT ENROLMENTS

The total number of students enrolled in the four 1-year courses at Yanco and C. B. Alexander Agricultural Colleges increased from 146 in 1972 to 161 in 1973.

Enrolments in the agriculture certificate course at Yanco Agricultural College increased from forty-six in 1972 to sixty-seven in 1973, whilst a decrease from eleven to seven occurred in the irrigation course.

At C. B. Alexander Agricultural College sixty-eight students enrolled in the 1973 agriculture certificate course compared with sixty in 1972. Enrolments in the advanced course in cattle husbandry increased from twenty-nine in 1972 to thirty in 1973.

Female students enrolled at Yanco and C. B. Alexander totalled two and eleven respectively.

ASSISTED STUDENTS

In 1973, eight students at Yanco were in receipt of financial assistance, one with a Commonwealth technical scholarship, one from soldiers' children education board, one from United Farmers and Woolgrowers Association, two from Repatriation Department and one from the Department of Education. The Rice Marketing Board of New South Wales sponsored two indigenes from New Guinea.

At C. B. Alexander Agricultural College, fourteen students were in receipt of technical scholarships and three were sponsored from national service vocational training grants.

FARM SECTIONS

Beef cattle numbers at C. B. Alexander Agricultural College decreased from 1,059 in 1971-2 to 1,050 in 1972-3. Value of sales of beef cattle increased from \$45,268 to \$63,777. Dairy cattle numbers increased from 222 to 259 following the transfer of the registered A.I.S. herd from Grafton Agricultural Research Station. Milk production increased from 411 121 kg of milk to 413 947 kg. In addition, 19 horses, 14 sheep, 21 angora goats and 293 head of poultry were on hand.

At Yanco Agricultural College, dairy cattle increased from 117 to 121 whereas beef cattle decreased from 125 to 120. Sheep numbers decreased from 1 320 to 1 097. Income derived from livestock sections increased from \$17,685 to \$22,889, whereas income from sales of fruit amounted to \$16,425.

6.1 REGULATORY AND TECHNICAL SERVICES: PLANTS AND PLANT PRODUCTS

PLANT DISEASES ACT

New Regulations, Proclamations and Notifications

Proclamation	— Restricted area in respect to strawberry growing, Parish of Wheeny, County of Cook.
Proclamation	— Commencing date for section 2 of the Plant Diseases (Amendment) Act.
Regulations 60 and 61	— Relating to detention of fruit and vegetables which are improperly graded or branded.
Regulations 19 and 20	— Potato Grading Regulations.
Regulation 16	— Amendment to definition of maturity of apples.
Notification	— Quarantine measures in respect to fruit fly control in the Shires of Wade, Leeton, Narrandera and Murrumbidgee.
Notification	— Quarantine area in respect to powdery scab of potatoes in the Ebor district.

Action was initiated to gain a uniform approach by all States in respect to quality grade standards for fruit and vegetables, to reduce the number of grades and to substitute numerical description of grades for the currently used descriptions which are confusing. Major fruit-growing industry organizations within N.S.W. have given their support. New proposed apple and pear grade standards have been accepted by industry and gazettal awaits interstate reaction to the proposals.

The new potato grading regulations extend to the retail level and considerable attention was given to this aspect by inspectors to ensure adoption of the new requirements.

Quarantine Areas

Banana bunchy top: Particular efforts have been made to clean up neglected and weedy plantations to permit more effective inspection. The incidence of bunchy top compared with previous years was:

<i>Number of Infected Plants</i>			
<i>District</i>	1970-1	1971-2	1972-3
Tweed	862	847	943
Brunswick	251	126	151
Richmond	12	4	5
	<u>1,125</u>	<u>977</u>	<u>1,099</u>

Banana weevil borer (*Cosmopolites sordidus*): The incidence of dieldrin resistance is increasing and the search for satisfactory alternative controls has, as a result, become of increased importance. It is expected that several promising alternative pesticides will be available in the near future. In the Coffs Harbour district weevil borer was found to be infesting a further 29 hectares, while in 125 previously infested hectares, no reinfestation was detected.

Citrus leaf miner (*Phyllocnistia citrella*): First recorded in the Far North Coast in 1971-2, this pest has spread rapidly as far south as South West Rocks. Efforts to prevent extension of the infested area have not been successful.

Queensland fruit fly (*Strumeta tryoni*): A widespread outbreak of Queensland fruit fly occurred in the M.I.A., including on a number of commercial orchards. A very intensive eradication programme was launched and the area was declared to be a quarantine area. To comply with the requirements of the quarantine notification, fruit growers organized aerial bait spraying of commercial orchards. This is believed to be the first occasion in Australia that the aerial baiting of an entire district has been undertaken. Intensive treatment of town areas quickly brought the pest under control in home gardens. The mild and moist winter conditions experienced to date has not aided the eradication measures. Some assistance was given to the district efforts.

Powdery scab of potatoes (*Spongospora subterranea*): During autumn 1973, this disease appeared in irrigated crops in the Coleambally, Berrigan and Barooga areas of southern N.S.W. There has been no further detection of the disease in the Ebor district where it appeared last year.

Fruit Fly Control

Town treatment programmes: The level of fruit fly infestation was higher than usual in treated towns, reflecting the greater fruit fly activity throughout the State. Another contributing factor was the inadequate standard of treatment applied by some council staff. However, control efforts at Broken Hill and Menindee were particularly effective and it is anticipated that with continued effort these areas will return to a state of freedom. Eradication measures were also undertaken at Balranald. Non-participating councils in areas where town treatment programmes could be expected to be successful were invited to give consideration to the scheme. As a result it is expected that a number of additional towns will participate next season.

Road blocks: Following representations from growers' organizations agreement has been reached with the Victorian Department of Agriculture on resiting the border check points at Tooleybuc and Barham. They will be moved north to protect the area between the Wakool and Murray Rivers against the possible introduction of infested fruit in a similar manner to the protection afforded by the Euston road block to the N.S.W. portion of the Sunraysia area. Interceptions of infested fruit at the Euston road block commenced earlier than in previous years and reached a peak during January–March. A full-time mobile road block was established in the M.I.A. early in 1973. This initially resulted in a large increase in the number of prosecutions against local residents for breaches of restrictions on the entry of fruit and packages. Provision has been made for the establishment of a second full-time mobile unit for this area.

Stored Products Pests

Insect infested central grain storage premises continued to be a problem and required regulatory action against a number of grain merchants. It is of some satisfaction that at least one merchant is embarking on a substantial programme of improvement to storage facilities. Particular attention has been given to infested storages in proximity to Grain Elevators Board storages.

Khapra beetle (*Trogaderma granarium*) was found in retail premises in Sydney and eradication measures were taken. This was the first record of this pest in premises in Australia.

Nursery Plants

Supervision of the heat treatment of grape vine rootlings and banana propagating material for the elimination of possible nematode infestation has been an important facet of inspectional duties in the appropriate districts. At Dareton, 500,000 grape vine rootlings were treated while on the North Coast 225,870 banana planting pieces were similarly treated.

Interstate and Intrastate Consignments

Following the development of post-harvest disinfestation treatments against fruit fly and modifications to the policies adopted by other States towards fruit from N.S.W., inspectors in certain districts had to devote increased time to supervision of treatments. The controlled entry of certain fruits into the M.I.A. has had similar effect. Overall, about 565 inter- and intrastate consignments of fruit were involved, and in addition 85 fumigations of export consignments were supervised on the M.I.A.

Sydney Markets

Citrus: Towards the end of the 1972 navel orange season, twenty-six lines were seized for dryness. Some early Queensland deliveries of navel oranges and mandarins showed evidence of ethylene injury from degreening treatments. In the latter part of the Valencia season, some South Australian lines showed evidence of apparent frost effects early in the season and eleven lines were rejected for dryness. The Directions of the Lemon Marketing Board resulted in extra large, small, and substandard lemons being absent from the market except during the period of short supply when restrictions were lifted. During this latter period a number of lines were downgraded. Grapefruit sold readily and imported lines from Israel and U.S.A. were offered during a period of short supply. Breakdown in the latter fruit was extensive and one line of 500 cartons was dumped. Israeli fruit was generally of good quality.

Pome fruits: Some Victorian apples, particularly Jonathans, while of good appearance on arrival, deteriorated rapidly. Some N.S.W. fruit from the Northern Tablelands showed the effects of poor storage. Western Australian apples which were marketed in Sydney for the first time for some years were of very good quality. Seizures of apples infested with fruit fly and to some extent codling moth were heavier than normal. Many lines of pears from major Victorian packing sheds consistently did not conform to grade and were downgraded.

Stone fruits: Substantial quantities of cherries in excess of demand were unsold and subsequently cast away. Several lots showed splitting from rain in early December. Some nectarines were fruit fly infested whilst a few South Australian lines were poorly presented. Considerable breakdown occurred in peach consignments of Elbertas from Queensland and Golden Queens from the M.I.A. and Victoria. Early consignments of plums from Queensland and later ones from the M.I.A. had appreciable breakdown. Many lines of apricots broke down due to heavy supplies and slow sales.

Tropical fruits: The banana industry operated a national Banana Marketing Development Scheme during the glut period when fruit which did not realize the set minimum price was destroyed and the growers compensated. Quality generally and presentation both showed improvement over last year. During December—January several Queensland consignments arrived in a heat-affected condition, and 5,000 cartons were cast away. Excessively hot conditions in December also resulted in breakdown in mangoes. Avocados held in cool store developed some breakdown.

Grapes: Grapes matured early and as a result there was very little trouble with immature lines.

Tomatoes: Spring rains caused weather damage to northern N.S.W. crops and resulted in much downgrading. High prices attracted Victorian and South Australian consignments which softened on colouring and were not as well received as local supplies.

Vegetables: There has been a good deal of poor size grading in potatoes from most sources, whilst greening, mechanical damage, insect injury and heat effects also caused downgrading. Rain caused harvesting problems in a number of districts. The main problems encountered with other vegetables were sunburn and weather damage to cucumbers, breakdown in M.I.A. parsnips, sweating of carrots packed in plastic bags, breakdown in late season rockmelons from southern N.S.W. and immature watermelons from Queensland.

General

Excluding the Sydney city and inner metropolitan areas the following inspections, etc., were carried out under the Plant Diseases Act:

Inspections of orchards and farms	16,300
Inspections of nurseries and resellers	1,970
Inspections of fruit shops	3,300
Inspections of home gardens	47,400
Inspections of grain storages	144
Instructions issued	1,040
Notices issued	670
Letters of warning issued	71
Prosecutions conducted —	
Market offences	4
Failure to control pest and disease	7
Breach of Regulations 28 and 29	14
Breach of M.I.A. quarantine	45
Other	5
Total	75
Prosecutions initiated —	
Failure to control pest and disease	4
Breach of Regulations 28 and 29	9
Breach of M.I.A. quarantine	36
Total	49

FRUIT CASES ACT

Following a number of meetings of the various subcommittees of the Metric Conversion Board, recommendations have been made for conversion to metric units of packages for most fruit and vegetables. However, before these can be put into effect in N.S.W., new legislation will be necessary as the existing Act does not grant powers to make the recommended regulations.

HORTICULTURAL STOCK AND NURSERIES ACT

Regulations under this Act were brought into effect on 1st March, 1973. Various industry organizations have been invited by the Minister to submit names of persons for consideration for appointment to a committee to advise on matters relating to the Act. The legislation has not yet been implemented due to delay in printing the necessary forms and certificates of registration.

POTATO GROWERS LICENSING ACT

Amendments to this Act extending licensing to persons using more than $\frac{1}{4}$ acre (0.1 ha) of land (instead of 1 acre (0.4 ha) previously) for the production of potatoes came into effect on 31st January, 1973. The number of licences issued during the year was 884 (1,068 last year) and 505 properties were inspected in respect to possession of a licence. Despite extension of licensing to a smaller area, the number of licences issued continues to decline, particularly for the smaller areas.

QUARANTINE ACT (COMMONWEALTH)

Administration

Advice on plant quarantine policy is tendered to the Australian Department of Health by departmental specialist officers. Plant quarantine provisions of the Quarantine Act are administered in N.S.W. by the Export and Import Branch of the Division of Horticulture. Revision of the staff structure put into effect during the year included provision of a second position of Supervising Inspector (Quarantine) in Sydney and the part-time quarantine positions at Port Kembla, Newcastle and Windsor being made full-time quarantine positions.

The elimination of treatment dockets which followed a review of procedures was another significant development during the year. Action was initiated to install two-way U.H.F. radio to control the movement of quarantine staff around Sydney. This is expected to increase the effective inspection time available to staff and thus improve overall efficiency.

Plant Quarantine Station

Completion of stage II in the construction of the laboratory and head-house greatly improved working conditions for staff of the Quarantine Station. The installation of mist propagators and daylight lamps has improved the capacity of the station to cope with difficult plants. Use was made of Rural Unemployment Relief funds to carry out general improvements to the station and to reduce a backlog of work. Further improvements including the provision of an air-conditioned section and heating and improved ventilation of the acrylic house and the installation of a fumigation chamber are planned.

Nursery Stock Imports

These increased by 2,444 plants to a total of 13,895, being made up of 4,964 orchids, 3,128 cacti and succulents, 120 deciduous fruit buds, 1,140 rose budding eyes, 801 ornamental shrubs and trees, 1,142 carnations, 932 chrysanthemums, 53 potatoes, 487 sugar cane cuttings, 792 bulbs and rhizomes and 336 aquatic plants. Initial inspection of nursery stock material revealed little pest or disease, apart from some mite and insect infestation. Some relaxation of conditions relating to orchid imports could result in increased imports.

Parcel Post

The number of parcels held for examination decreased by 1,396 to 12,606. Of these 2,550 were detained for further examination, treatment or destruction, an increase of 336.

Overseas Passenger Vessels

A total of 181 commercial passenger and naval vessels were attended on arrival, a reduction of 16. Articles held for treatment or destruction totalled 358.

Airport Inspections

The introduction of larger aircraft resulted in the number of overseas flights into Mascot decreasing from 9,240 to 9,023, but the number of passengers increased from 627,305 to 762,016. Quarantine examination of passenger articles increased from 24,970 to 37,542. Goods held and forwarded to Export and Import Branch for decision increased from 186 to 379. The number of seizure notices issued for subsequent action by Customs totalled 107. Quarantine prosecutions totalled 10, while 141 offences were dealt with by the Collector of Customs under part 15 of the Customs Act. Numbers of goods intercepted and destroyed included:

<i>Fruit</i>		<i>Seeds</i>	
Pome	4 387	Maize	85 kg
Tropical	2 406	Beans	382 kg
Citrus	5 099	Vegetables & flowers	3 539 pkgs
Stone	209 kg	Wheat, cereal grain &	158 kg
Grapes	76 kg	pasture seed	
Litchi	75 kg	<i>Plants</i>	
Olives — Green	17 kg	Plants & cuttings	2 969
Dried fruit	165 kg	(ornamental)	
<i>Vegetables</i>		Commercial fruit	823
Garlic	57 kg	Bulbs	284 pkgs
Onions	28 kg	Flowers	222 pkgs
Other vegetables	199 kg	Mushrooms	437 pkgs
<i>Nuts</i>		Soil	375 pkgs
Chestnuts	226 kg	Fruit cases	145
Walnuts	354 kg	Straw packing	259 pkgs
Raw peanuts	20 kg	Herbs	289 pkgs
Other nuts	95 kg	Raw cotton	10 pkgs
		Wood/bamboo	128 pkgs

The number of consignments of cargo examined at the various bonds totalled 3,101, of which 518 were directed to Export and Import Branch for further action. Fresh fruit and vegetable examinations were:

Strawberries	20 752 pkgs	Gooseberries	334 pkgs
Mushrooms	1 488 pkgs	Celery	29 pkgs
Asparagus	1 360 pkgs	Whitlof (chicory)	449 pkgs
Cucumbers	860 pkgs		

Overseas flights into Richmond R.A.A.F. base decreased to 508 from 547 the previous year. Passengers increased to 8,229 from 7,212, whilst cargo decreased to 7 745 450 kg from 8 076 350 kg.

General Wharf Inspections

A total of 979 (increase of 52) overseas ships were visited during the year to inspect goods for which a quarantine permit is required before release. Goods inspected included:

Motor vehicles 23,904 of which 4,135 required steam cleaning.
 Soybean meal 19,735 bags of which 16,216 required fumigation.
 Soybean meal in bulk 1 887 tonnes, no treatment required.
 Safflower in bulk 19 366 tonnes for processing under supervision.
 Linseed in bulk 11 641 tonnes for processing under supervision.
 Rye in bulk 1 071 tonnes for processing under supervision.
 Phaseolus beans for processing and grocery trade totalled 17 974 bags.
 Peanuts and walnuts 685 tonnes of which 286 required treatment.
 Other nuts totalled 4 596 tonnes of which 76 required treatment.
 Cotton imports totalled 16,513 bales for processing under supervision.
 Copra imported totalled 16 613 tonnes of which 9 312 were fumigated due to heavy insect infestation.
 Pasture seeds totalled 1 334 tonnes.
 Jute waste totalled 21 689 of which 2,037 bales were contaminated with rice straw and were processed under supervision.
 Cocoa beans totalling 308 tonnes required fumigation due to insect infestation.
 Coffee beans totalling 112 tonnes required fumigation due to insect infestation.
 Importations of 10,518 bags and 1,250 cartons of onions and 1,742 bags and 1,470 cartons of garlic were released after inspection.
 Citrus (mainly grapefruit) totalled 21.4 tonnes.

Timber

Timber imports at approximately 708 000 cubic metres were less than the previous year. Imports of Douglas Fir from North America declined slightly whilst most other timbers increased, except Parana Pine which decreased by 70 per cent.

Timbers requiring quarantine treatment were:	m ³
Meranti	7 035
Hemlock	4 310
New Guinea Pine	1 050
S.E. Asian logs	698
Mahogany	3 894
Douglas Fir	9 739
Nyatoh	27
Teak	159
New Zealand Beech	3
New Guinea Cedar	6
Western Red Cedar	339
Parana Pine	47
	27 307

This is an increase of 9 639 m³ on the previous year, mainly due to infestations of Carpenter Ants from the west coast of North America requiring 7 552 m³ of Douglas Fir to be treated. The main insect infestations were *Scolytidae*, *Platypodidae* and *Campanotus pennsylvanicus* in Hemlock and Douglas Fir, *Bostrychidae* and *Lyctidae* in South East Asian hardwoods and *Curculionidae* in Western Red Cedar.

Containerized Cargo

A new container terminal opened in February. The number of container vessels plying to the Port of Sydney has increased from twenty-eight to thirty-five with thirteen vessels on the United Kingdom-Europe run, eight to Japan, twelve to the U.S.A. and two to New Zealand. A total of 67,822 containers were landed in Sydney from these container vessels. Approximately 42,000 containers were placed on immediate delivery list following manifest perusal, of which 445 were given a follow-up inspection and 31 found to be incorrectly manifested. The remainder of the containers were directed to depots for unloading and inspection where 489 were found to require some quarantine action due to infestation or contamination. Containers discharged from conventional cargo vessels totalled 5,593 of which 963 were quarantined for soil contamination or directed to depot for unpacking and further inspection.

Household Effects, Furniture, etc.

These items are subject to quarantine inspection by appointment at approved premises in the metropolitan area, the main concerns being the use of straw packing and borer infestation in timber. At Grace Bros Bond, 3,976 consignments comprising 46,314 cases totalling 1 969 m³ were inspected and at the Department of Supply, 5,557 cases comprising 799 m³. Items quarantined and requiring treatment totalled 217. Other appointment inspections at various localities involved inspection of 2,944 cases comprising 576 m³. Of these packages, forty-two were detained for treatment.

Approved Processors

Commodities subjected to quarantine restrictions and permitted to be imported for processing under supervision at approved premises included such items as soybeans, linseed, safflower, rye, phaseolus beans, peanuts, copra, cotton, jute, etc., together with laboratory samples of soil. The approved premises were subjected to regular inspections.

Customs Liaison

To expedite movement and maintain better control over cargo on the wharves an Inspector was assigned to duties in liaison with Customs. A total of 1,114 ships had Customs Permission Lists for unentered goods going into bond.

Quarantine Treatments

Quarantine treatments applied at approved premises were constantly supervised, including fumigation, heat treatment, unpacking of straw packing material for destruction, steam cleaning and cleaning of pasture seeds.

Inspections at Export and Import Branch

During the year 5,893 consignments of various goods were directed to Export and Import Branch for examination. Action was taken on 1,262 consignments which required treatment.

General

The number of permits issued during the year was 43,231. This was the first complete 12-month period for which quarantine permits for pallets were not required.

A total of 3,170 quarantine specimens of plants and plant parts was examined by plant pathologists and prescribed treatments given where necessary. In many instances follow-up inspections were made of plants grown in quarantine from these importations. Over 1,200 instances of interceptions of insects were also recorded.

Of 389 quarantine samples of seeds examined by the Seed Testing Laboratory, 79 contravened one or several provisions of the Act, 53 contained prohibited weed seeds, 37 excessive quantities of restricted crop seeds and 22 excessive quantities of earth. The laboratory hand-cleaned 71 packets of seed (trade and experimental samples) to facilitate release.

The Giant African Snail was found in a ship's hold from New Guinea which had contained empty pallets. All pallets were fumigated after landing on the wharf.

The infestation of Khapra beetle reported under the Plant Diseases Act is believed to have originated in an importation of lentils earlier in the year. Routine inspections of premises handling high risk imported produce are being conducted under the Plant Diseases Act.

COMMERCE (TRADE DESCRIPTIONS) ACT (COMMONWEALTH)

The Division of Horticulture, through its Export and Import Branch, and district inspectors, administers the Commerce (Trade Descriptions) Act in N.S.W. on behalf of the Department of Primary Industry, in respect to exports of fresh fruit and vegetables, grain, flour, seeds, plants, field peas, milled products, etc. While most of this work is concentrated in Sydney approximately 1,100 inspections of produce were conducted in country centres.

Exports (Grain) Regulations

Due to unfavourable crop conditions the volume of export wheat and sorghum declined markedly. No barley, maize or oats were exported under the exports regulations. Statistics for the year were:

	<u>Sydney</u>	<u>Newcastle</u>	<u>Total</u>
Grain ships surveyed	40	22	62
Grain ships rejected at initial survey.	17	8	25
Bulk wheat (tonnes) — Loaded	636 677	374 454	1 011 131
— Rejected	32 307	5 814	38 121
Bagged wheat (tonnes) — Loaded	355	Nil	355
— Rejected	24	Nil	24
Bulk sorghum (tonnes) — Loaded	Nil	94 538	94 538
— Rejected	Nil	Nil	Nil

Although not subject to the regulations, 50 901 tonnes of milled rice were inspected for certification for export.

Exports (Flour) Regulations

Shipments through the Port of Sydney totalled 37 962 tonnes. Container loads inspected in the Riverina were shipped through Melbourne and are not included in the above figure.

Exports (General) Regulations

Exports included:

Pasture seed	3 794 pkgs	Cereal seeds for sowing	1 017 pkgs
Field peas	2 558 pkgs	Nuts	35 pkgs
Vegetable and flower seeds	2 241 pkgs	Plants	121 pkgs
Tree seeds	17 cons		

In addition a number of items in the above classifications and which were not of Australian origin were inspected for certification prior to re-export to overseas destinations.

Exports (Fresh Fruit) Regulations

The general standard of produce was good. However, there was an unsatisfactory outturn of coastal lemons in the United Kingdom, partly due to the use of an insufficiently strong carton for packaging. Certain intransit problems in some shipping containers also appeared to have contributed to the problem. A feature of both fruit and vegetable exports from N.S.W. is the large number of small consignments to Pacific Island destinations.

Shipments of fruit from the Port of Sydney were:

Apples	91 803 pkgs*	Apricots	4 687 pkgs
Pears	90 823 pkgs*	Peaches	12 791 pkgs
Oranges	58 971 pkgs*	Plums	13 643 pkgs
Mandarins	3 468 pkgs*	Nectarines	4 502 pkgs
Lemons	20 008 pkgs*	Cherries	7 182 pkgs**
Grapefruit	3 480 pkgs*	Strawberries	3 641 ctns
		Tomatoes	26 818 pkgs***

* Approximately 20 kg package

** Approximately 5 kg package

*** Approximately 10 kg package

Exports (Fresh Vegetables) Regulations

Rejections of potatoes were at times fairly heavy mainly due to excessive soil adhering to the tubers. Rejections of Chinese cabbage were also fairly heavy due to insect infestation. Main destinations were the Pacific Islands and some Asian ports with many consignments going by air freight. Shipments included:

Potatoes	78,206 bags	Garlic	2,775 bags
Onions	59,308 bags	Miscellaneous	88 912 pkgs

General

The numbers of export permits and phytosanitary certificates issued during the year were:

Export permits — Fruit	2 444
Vegetables	2 905
Flour	518
Grain	87
Exports (General)	437
	6 391

Phytosanitary certificates 5,907 covering 173 961 pkgs

PEST DESTROYERS ACT

The present pesticide legislation makes certain provisions for the registration, labelling, standard and sale of fungicides, insecticides and herbicides. During the year, the Intra-Departmental Pest Destroyers Committee continued to meet regularly to consider applications for registration and allied matters. A total of 2,140 applications for registration were considered, of which 441 were for new products or variations of existing products and 1,699 were for re-registration of existing products.

It is proposed that new legislation which will be put before Cabinet early in the coming year will also require registration of such substances as plant growth regulators, rodenticides, defoliants and adjuvants. In addition to exercising adequate control over the sale of pesticides, it will be an offence to use a pesticide other than in accordance with the registered label directions.

In February, 1973, the position of Registrar of Pesticides and the Pesticide Registration Section were established. The Registrar is responsible for all matters associated with the registration of pesticides under the Pest Destroyers Act 1945 and the proposed new legislation.

FERTILIZERS ACT

From 1st January, 1973 all registrations under this Act were required to show the analysis of all nutrients in the elemental form and to describe in the registration and on the labels trace elements and pesticides, where they are claimed to be present.

For several years the Department has been attempting to prevent fertilizers being sold under the name of "blood and bone" where the product is not wholly blood and bone. Following a survey of about eighty brands of "blood and bone" fertilizers being sold in N.S.W., it was found that several companies were still selling "blood and bone" fertilizers containing up to 80 per cent of the nitrogen as urea. These companies have been warned that prosecutions could result from a continuation of this practice.

AGRICULTURAL SEEDS ACT

Of 698 samples representing 38 crop species taken and tested under this Act, 488 samples conformed and 210 did not conform to minimum requirements. Of the latter, 153 failed to meet purity requirements, 40 failed to meet germination requirements and 17 failed to meet both requirements. One prosecution was undertaken and 81 warnings issued for breaches of the Act.

SEED PRODUCTION

Seed production officers located in the main seed producing centres, together with District Agronomists throughout the State, supervised the production of registered cereal seed and of certified seed of pasture species, maize, sweet sorghum, beans and potatoes.

Foundation and Registered Cereal Seed

Foundation seed of recommended and promising cereal varieties was produced on seven research stations and distributed to registered seedgrowers throughout the State. This involved 64 hectares of wheat, 40 hectares of oats and 9 hectares of barley. Of a total of 309 (323 in 1971-2) registered seedgrowers, 149 (162) were supplied with seed of 17 (14) wheat varieties, 105 (112) with seed of 13 (11) oat varieties and 55 (49) with seed of 6 (11) barley varieties. The Department maintained stocks of the cereal rye varieties Weethalle and Strain 8, and distributed seed of both to four seedgrowers for seed increase purposes.

Certified Pasture Seed

Adverse seasonal conditions again severely restricted the quantity of certified seed produced, total production being 627 tonnes, compared with 520 tonnes in 1971–2.

Subterranean clover (*Trifolium subterraneum*): Production of certified seed was confined to the southern Riverina and totalled 209 tonnes (122 tonnes in 1971–2) comprising Woogenellup 125 tonnes, Dwalganup 41 tonnes, Mt Barker 39 tonnes and Bacchus Marsh 4 tonnes.

Barrel medic (*Medicago truncatula*): The total production of 21 tonnes of certified seed of the Jemalong cultivar was harvested from one area of 182 hectares.

Lucerne (*Medicago sativa*): Certified lucerne seed production amounted to 207 tonnes of the Hunter River cultivar, most of this coming from irrigated central west crops and Riverina dryland areas. Yields ranged from 33 kg/ha to 380 kg/ha. Many seed lots again contained a high proportion of hard seeds and required scarification.

Perennial ryegrass (*Lolium perenne*): The total production of 112 tonnes of certified seed was of the Kangaroo Valley cultivar.

Phalaris (*Phalaris tuberosa*): Adverse weather conditions in central and southern areas severely curtailed seed production of all cultivars. Good yields were achieved only on the northern tablelands. The production of certified seed of Australian phalaris amounted to 9 tonnes, Seedmaster 9 tonnes and Sirocco 3 tonnes.

Tall fescue (*Festuca arundinacea*): Hot weather prior to harvest led to reduced seed yields. Thirty-six tonnes were certified.

Cocksfoot (*Dactylis glomerata*): No certified seed was produced because of adverse seasonal conditions and limited demand.

Broadleaf paspalum (*Paspalum wettsteinii*): Adverse seasonal conditions again reduced seed yields. Three tonnes were certified. Additional areas have been sown in an attempt to meet a continuing demand for seed of this species.

Kikuyu (*Pennisetum clandestinum*): The first commercial release of seed was achieved during the year with the production of 18 tonnes of certified seed of the Whittet cultivar.

White clover (*Trifolium repens*): Eighty kg of certified basic seed of the Haifa cultivar were produced during the year. This will be used for sowing areas for certified seed production.

Hybrid Maize

Production of certified hybrid maize seed totalled 372 tonnes. Carryover seed retested for certification purposes amounted to 203 tonnes.

Sweet Sorghum

Six tonnes of certified sweet sorghum seed were produced.

Beans

Fifty-five hectares of field beans were inspected for certification purposes from which one hundred and sixty-three sacks were harvested for further cleaning.

Potatoes

The number of growers who applied for certification of seed potatoes reached an all-time low, viz. 57 who planted 249 ha and achieved an estimated total production of 3 700 tonnes of certified seed. In addition 14 growers had 94 ha accepted for "approved" seed purposes, estimated production being 1 000 tonnes.

SEED TESTING

The table shows a breakdown and comparison of samples submitted to the Seed Testing Laboratory for the years 1970-1 to 1972-3.

<i>Type or Source of Seed</i>	<i>Samples Received</i>		
	<i>1970-1</i>	<i>1971-2</i>	<i>1972-3</i>
Quarantine	351	464	389
Regulatory	41	124	883
Certified pasture species	607	329	273
Certified maize, sorghum, beans	416	483	364
Miscellaneous industry samples	432	699	450
Cotton	—	191	85
Rice	15	58	15
Departmental	770	672	724
Other Departments	28	82	82
Seeds for identification	121	69	65
	<u>2,781</u>	<u>3,171</u>	<u>3,330</u>

Points of interest were:

- A 5 per cent overall increase in samples received compared with 1971-2 and a 20 per cent increase on 1970-1.
- A further reduction of certified pasture seed samples received due to adverse seasonal conditions.
- Continuing major increases in regulatory samples.

NOXIOUS PLANT CONTROL

The State Government made available to the Department of Local Government \$700,000 during 1972-3 for distribution to councils and Pastures Protection Boards for the control of specific noxious plants on the joint recommendation of the Ministers for Agriculture and Local Government. Pastures Protection Boards were allocated \$44,400 for galvanized burr control on a \$2 for \$1 basis. The remainder of the allocation was distributed to councils for control of groundsel bush, serrated tussock, nodding thistle, boxthorn, and Bathurst, Noogoora and galvanized burr throughout the State. Regular inspections of the Hunter River Valley showed a continuing satisfactory Indian hemp (*Cannabis sativa*) control situation.

ANALYTICAL SERVICES

Plant Nutrition

The tables summarize the analytical work carried out during the year:

No. of samples:	Diagnostic	1,207
	Survey	428
	Trial	6,704
		<u>8,339</u>
No. of analyses:		52,977

Atomic Absorption Spectrophotometer Analyses

(No. of samples 5,979)	
Potassium	5,689*
Calcium	5,883*
Magnesium	5,822*
Sodium	5,177
Manganese	5,669
Copper	3,251
Zinc	5,157
Iron	779
	<u>37,427</u>

* 150 done by X-ray spectroscopy

** 25 done by X-ray spectroscopy

Other Analyses

(No. of samples 2,360)

Nitrogen	4,486
Phosphorus (colorimetric)	357*
Phosphorus (auto analyser)	5,493
Potassium (flame photometer)	140
Boron	1,531
Chloride	1,291*
Molybdenum	505
Sodium (flame photometer)	226
Sulphur	95**
pH	214
Nitrates	259
Ignition loss	2
Neutralising value	9
Gypsum	22
NH ₄ -N	6
Dry matter (moisture)	914
	<u>15,550</u>

Waters

Provision of the water analysis and advisory service continues to be of increasing benefit to the rural community by providing information on the suitability of waters for irrigation, stock use and industries associated with agriculture. During the year, 567 water samples (2,835 analyses) were tested at Rydalmere and 2,500 water and soil samples (7,500 analyses) at regional offices. The increasing number of water samples submitted during dry times shows that irrigators are acknowledging the importance of water quality and are seeking accurate information on the water available. For example, it is certain that many crop losses have been avoided by irrigators on tidal sections of the Hunter and Williams Rivers because water samples have been tested by the regional office and found unsuitable before irrigation was undertaken. Salinity levels of the Murray and Darling Rivers are monitored at Dareton so that irrigators can be aware of any increases that might damage crops, especially citrus, stone fruit and vegetables which are very sensitive to salinity and chloride levels, particularly if under spray irrigation.

Pesticides

Analytical service and advice were provided to farmers, home gardeners, and municipal councils in relation to pesticide formulation.

Yanco Laboratories

A number of analytical determinations were carried out for various members of the Rice Section during the year. Analyses of steep liquors and parboiled samples from quick cooking rice were completed for the Rice Growers Co-operative Mills Limited as well as the usual moisture calibrations for the Rice Marketing Board.

Soils

The soils advisory service dealt with 4,970 samples during the year, an increase of 19 per cent over 1971-2 figures and some 900 reports were issued, an increase of 29 per cent.

PLANT HEALTH DIAGNOSTIC SERVICES

District officers, primary producers and home gardeners submitted 1,110 specimens for examination and assessment of insect pest problems and 1,043 specimens for examination for presence of disease. Control measures were recommended where necessary. Similarly, 743 soil and plant samples were examined for the presence of plant parasitic nematodes and 47 specimens of root knot nematodes were identified. Enquiries on mushroom culture and disease control totalled 230.

QUALITY ASSESSMENT

Australian Inoculants Research and Control Service

This service was established and financed by the Australian Agricultural Council to control the quality of legume seed inoculants during production and retailing in all States. During the year 339 cultures submitted by inoculant manufacturers were tested prior to being used to impregnate the peat carrier; of these 303 were satisfactory. From the broths passed as satisfactory, 240 batches of peat inoculant were prepared and submitted for testing prior to sale. Two hundred and eight of these were passed and given an expiry date of six months from the date of testing.

Country peat surveys, during which inoculants are purchased for testing, were carried out in Western Australia, South Australia and the South Coast region of N.S.W. with the following results:

	<i>Tested</i>	<i>Satisfactory</i>
N.S.W. South Coast	46	31 (67%)
South Australia	29	29 (100%)
Western Australia	58	54 (93%)

Certification of Export Cereals

As in previous years, analyses were undertaken to enable issue of quality certificates for a limited number of shipments of wheat, flour and grain sorghum.

Uniform Wheat Quality Testing

The Biological and Chemical Research Institute, Rydalmere, continued to collaborate in the uniform quality testing scheme. Heaviest requests were for testing of new lines from the Wagga and University-Narrabri breeding programmes, as well as for a number of interstate named varieties.

NEW PLANT DISEASES

The most noticeable of several new plant diseases recorded during the year was a second species of *Melampsora* on poplars — *M. larici-populina* Kleb. attacking Lombardy poplar (*Populus nigra* var. *italica*) was recorded in the Sydney district in February, 1973, and a survey in May showed it to be widespread in southern N.S.W. Fuchsia rust (*Pucciniastrum epilobii* Oth) was recorded in a Sydney suburban home garden and later found severely damaging plants in a commercial nursery. Peanut mottle virus was identified from a peanut crop at Wee Waa and the common *Cladosporium* leaf spot on ornamental taro (*Colocasia esculenta*) was confirmed as *Cladosporium colocasiae* Sawada. About 1,500 specimens were added to the Biology Branch herbarium.

6.2 REGULATORY AND TECHNICAL SERVICES: ANIMALS AND ANIMAL PRODUCTS

REGULATORY DISEASE CONTROL

Disease Notification

For some years, owners of sheep have been notified when lice infestation has been detected in sheep on adjoining properties, so that appropriate precautions could be taken against possible transmission. The practice has now been extended to include anthrax, Johne's disease, tuberculosis, trichomoniasis and active bovine brucellosis. The notifications are confidential.

Tuberculosis (Cattle)

The tuberculin testing programme was expanded by the declaration of new areas for compulsory testing. Nineteen pastures protection districts in the Western Division and adjoining the State of Victoria were declared protected areas. Those in the former category were so declared because of a low incidence of tuberculosis, while the areas along the Victorian border were selected because many cattle are consigned from there to Victorian abattoirs, making difficult the tracing of those found infected.

As in the past, most testing took place in the nineteen original protected areas declared for eradication purposes. They embraced the more closely settled coastal districts with one inland area and were originally selected because of their high content of dairy stock. Outside protected areas, herds suspected of being infected are quarantined and subjected to compulsory testing.

All cattle being sold are required to bear tail tags identifying the property of origin so that in the event of tuberculosis being detected at slaughter, the remainder of the herd can be tested. The number of cattle found infected at abattoirs and successfully traced by their tail tags was 232. This led to sixty-nine herds being found infected.

Routine tests in protected areas and initial tests of quarantined herds are carried out by approved practising veterinarians where available. Elsewhere, the testing is performed by departmental veterinary officers or Pastures Protection Board veterinary inspectors. If reactors are detected, retests are undertaken by veterinary officers or veterinary inspectors until there have been two complete negative tests except where the reactors fail to show lesions of tuberculosis on slaughter, when only a single retest is performed, if negative.

The total number of tuberculin tests performed during the year was 1,098,592, similar to the previous year's figure of 1,076,349. Positive reactors totalled 1,133 or 0.10 per cent compared to 0.15 per cent the previous year. Lesions were not found in 597 reactors representing 53.6 per cent, or 0.05 per cent of all cattle tested. This compares with 38.41 per cent of reactors or 0.085 per cent of cattle tested during the previous year. Testing revealed infection in 1.6 per cent and 0.9 per cent of dairy and beef herds respectively. The amount paid to private veterinarians for testing was \$367,595. Tuberculosis was found in only 0.009 per cent of cattle slaughtered at abattoirs, exclusive of reactors.

Because of Commonwealth export licensing requirements, some abattoirs refused to accept reactors for slaughter, causing problems in salvaging the carcasses of these animals and sometimes necessitating reactors being trucked hundreds of miles to other abattoirs. The practice was continued, of having specimens of suspected tuberculous lesions found at abattoirs subject to laboratory examination. The number so examined was 451 of which 350 (76.9 per cent) were confirmed as being due to tuberculosis.

One batch of tuberculin used was found to be associated with a high proportion of no visible lesion reactors and with non-oedematous swellings, 4 to 8 mm in up to 10 per cent of cattle tested. Skin tuberculosis caused test interpretation problems in one area. From one animal so affected, a non-chromogen Runyon group III *Mycobacterium* of the *Mycobacterium intracellulare* complex was isolated.

Protected areas: There are nineteen original eradication areas, one of which was extended to embrace additional country. The areas contain approximately 2 million head of cattle with about equal number of dairy and beef animals. Tests performed totalled 703,308, a reduction on the previous years figure of 868,299 caused by less frequent testing in many areas because of the low incidence of tuberculosis. Reactors numbered 274 or 0.04 per cent, a significant reduction on the previous year's figure of 580 (0.067 per cent). In routine tests involving 594,465 cattle, there were only 58 reactors or 0.01 per cent compared with 187 (0.025 per cent) the previous year.

Lesions of tuberculosis were not found in 46.4 per cent of reactors. Of those detected in routine tests 72.4 per cent were no visible lesion reactors. However, those failing to show lesions represented only 0.018 per cent of all cattle in protected areas and 0.007 per cent of those tested in routine tests.

Cattle in most areas are now routinely tested only every 4 years. The early declaration of some protected areas as tuberculosis-free areas, is considered likely during 1973-4. The situation is particularly favourable in the Port Macquarie area where routine testing of 135,000 cattle revealed only six reactors, of which only one showed tuberculous lesions. When areas have been declared free from tuberculosis, routine testing will cease, and reliance will be placed on tail tag traceback from abattoirs to monitor the tuberculosis status of herds.

Testing commenced in the nineteen recently gazetted protected areas in the Western Division and along the Victorian border.

Particulars of testing are summarized in the accompanying tables.

Tuberculin Testing in Protected (Eradication) Areas

Purpose of test	No. cattle tested	No. of reactors	Reactors per cent	No. of reactors *NVL	Reactors *NVL per cent
Routine tests	594,465	58	0.01	42	72.4
Retests	50,019	201	0.40	75	37.3
Introductions	58,824	15	0.03	10	66.7
Total	703,308	274	0.04	127	46.4

*NVL = no visible lesions

Tuberculin Testing in Protected Areas — Western Division

Purpose of test	No. cattle tested	No. of reactors	Reactors per cent	No. of reactors *NVL	Reactors *NVL per cent
Routine tests	23,734	83	0.35	65	78.3
Retests	6	—	—	—	—
Introductions	254	1	0.39	1	100.0
Total	23,994	84	0.37	66	78.6

*NVL = no visible lesions

Tuberculin Testing in Protected Areas — Victorian Border

Purpose of test	No. cattle tested	No. of reactors	Reactors per cent	No. of reactors *NVL	Reactors *NVL per cent
Routine tests	88,795	15	0.02	10	66.7
Retests	46	—	—	—	—
Total	88,841	15	0.02	10	66.7

*NVL = no visible lesions

Quarantine areas: Outside protected areas, infected herds were quarantined and tested until two negative herd tests had been obtained. Particulars of testing are shown in the accompanying table.

Tuberculin Testing in Quarantine Areas

Purpose of test	No. herds tested	No. cattle tested	No. reactors	Reactors per cent	No. of reactors *NVL	Reactors *NVL per cent
Initial tests	365	83,131	510	0.61	276	54.1
Retests	224	107,410	203	0.19	98	48.3
Total	589	190,541	713	0.37	374	52.4

*NVL = no visible lesions

The number of herds placed in quarantine during the year was 217 while 188 were released from quarantine. Sixteen herds remained in quarantine for the full year.

Tubercle-free herd scheme: In this scheme of voluntary accreditation, 28 herds containing 8,394 head of cattle were tested. There were 5 reactors of which three did not show visible lesions. A further 25 herds accredited during the previous year for 2 years were not tested.

In one large beef herd, the only reactor at a routine test was a calf. Shortly after the test, twenty-three cows which had given negative reactions were consigned to an abattoir where lesions of tuberculosis were found in five, the carcasses of three being totally condemned. Further testing of the herd is to be undertaken.

Tubercle-free milk schemes: These schemes involve herds from which milk is sold unpasteurized. One scheme, which applies to areas supervised by the Dairy Industry Authority, is administered by that body. The other covering mainly the smaller urban areas and administered by the municipal and shire councils has now been discontinued. However, before discontinuance, 528 cattle were tested in 5 areas. There were no reactors.

Under the Dairy Industry Authority scheme, 299 head of cattle were tested with no reactors. Increased milk pasteurization and the extension of other anti-tuberculosis programmes has progressively reduced the number of herds tested under the scheme.

Miscellaneous tuberculosis testing: The number of cattle voluntarily tested for interstate and overseas movements and for other purposes, was 82,687. There were 42 reactors of which 17 did not show lesions of tuberculosis.

Tuberculosis (Pigs)

Eight herds were placed in quarantine, which was maintained on a further four herds in which tuberculosis had been diagnosed during the previous year. Twelve herds were released.

There were 986 pigs tested in 20 herds, 21 animals being positive.

Pig specimens subjected to pathological and bacteriological examination for suspected tuberculosis numbered sixty-six. The disease was confirmed in fifty-six (85 per cent).

Tuberculosis (Poultry)

Tuberculosis was detected in eighteen flocks which were placed in quarantine. Twelve were in the recognized enzootic area for the disease in the southwest of the State. Control was by sanitation. Quarantine was maintained on twenty-eight flocks infected before the start of the year. Twelve were released.

The tuberculin test was applied to 623 birds of which 45 were positive.

Brucellosis (Cattle)

Controls were introduced over cattle reacting to brucellosis tests. Regulations were gazetted requiring reactors to be specially branded and identified by a distinctive ear tag. Immediate slaughter is not required but movement from the property must only be to an abattoir. Compensation does not apply.

The official control programme based on the compulsory vaccination of female calves to reduce the incidence of the disease to a level that will permit the economic adoption of a test and slaughter campaign, was continued. The scheme provides for the vaccination, at Government expense, of all calves within protected areas which embrace most of the coastal plain and one inland area. Outside these areas vaccination is undertaken on the same basis in herds found infected. The properties concerned are constituted as quarantine areas by agreement with owners although no restrictions are applied to the introduction or removal of cattle except that generally applying to brucellosis reactors.

Testing is by approved practicing veterinarians but where practitioners are unavailable, vaccinations are undertaken by official veterinarians. The vaccine normally employed is strain 19, the use of which is restricted to calves between three and nine months of age, except that with the permission of the district veterinary officer, either strain 19 or strain 45/20 vaccine can be used on older females and the latter vaccine on bulls.

Within protected and quarantine areas, 109,830 calves were vaccinated in 6,232 dairy herds and 373,392 calves in 10,682 beef herds. Owners not covered by this programme were encouraged to voluntarily have their calves vaccinated. This resulted in a further 1,173 calves in 40 dairy herds and 161,554 calves in 3,069 beef herds being vaccinated. The numbers of dairy and beef cows vaccinated were 1,774 and 23,459 respectively. Approximately half were vaccinated with strain 19 and the remainder with strain 45/20. The amount paid to private veterinarians for vaccinations was \$323,383.

To identify infected herds outside protected areas for vaccination purposes and to establish data on the incidence of the disease throughout the State, large scale surveys were undertaken. These included milk ring tests at milk depots and factories, the testing of serum samples from cattle being slaughtered at abattoirs and the testing on properties of cattle suspected of being infected or randomly selected. Milk ring testing surveyed 5,678 dairy herds of which 3,146 containing 281,252 breeding cows were found infected. Abattoir testing surveyed 19,856 herds, infection being found in 1,956 containing 239,392 breeding cows. Field testing involved 327 dairy herds and 3,214 beef herds. Of the former, 81 containing 9,155 breeding cows were found infected while the disease was shown to be present in 685 beef herds containing 87,479 breeding cows.

Testing of serum for survey and other purposes was normally by the Rose Bengal plate test or the agglutination test with reacting samples being retested by the complement fixation method to eliminate vaccinal reactions. The total number of serum samples tested was 8,644 from dairy cattle and 203,705 from beef cattle. Positive reactions were given by 985 of the former and 10,642 beef animals. Some problems of carry over and prozone reactions were encountered using the technicon auto-analyser for the complement fixation tests. Alternative automated or semi-automated systems were examined resulting in highly promising results from the use of an automated microtitre system.

Fifty-seven cultures of *Brucella abortus* were biotyped at the World Health Organization Reference Centre, Commonwealth Serum Laboratories, Melbourne. Results were received for thirty-five of which twenty-five were biotype 1, nine were biotype 2 and one was strain 19.

The voluntary brucellosis-free scheme was maintained, three herds being accredited.

Brucellosis (Pigs)

Fifty-six herds were accredited under the brucellosis-free herd scheme. Serum samples submitted to the agglutination test numbered 3,060, of which 3 were positive and 15 doubtful.

Anthrax

There were forty-one outbreaks, a significant increase on the sixteen of the previous year. All were in the recognized anthrax belt in the west of the State, most being in either the extreme north or the extreme south of the belt. Most of those in the north occurred in cattle running on Gwydir River watercourse watercourse country which was flooded at the time. Six of the outbreaks in the southwest were on irrigated farms.

Particulars of outbreaks and deaths are given in the accompanying table. Stock on affected properties were quarantined and vaccinated. In one herd, losses continued until cattle were revaccinated because penicillin was administered at the same time as the vaccine. Further losses later occurred on this property necessitating a third vaccination. A small trial by the vaccine manufacturer confirmed the inhibitory effect of penicillin on the immunogenicity of anthrax vaccines. Two of the outbreaks were each associated with a case of human infection which was successfully treated.

Anthrax Outbreaks

District	No. outbreaks	No. stock quarantined				No. deaths			
		Cattle	Sheep	Pigs	Horses	Cattle	Sheep	Pigs	Horses
North-west	14	20,660	39,300	-	185	291	-	-	-
South	1	109	780	-	-	4	2	-	-
South-west	17	3,631	1,625	45	14	55	10	6	-
West	9	1,677	8,697	-	6	36	259	-	1
Total	41	26,077	50,402	45	205	386	271	6	1

Stock vaccinated totalled 141,317 on 257 properties, an increase on a 1971-2 figure of 82,274 head vaccinated on 159 properties.

The policy of imposing quarantine during summer on stock routes and reserves on which anthrax had occurred during the preceding 5 years was again implemented. The ten routes and reserves quarantined last year were again quarantined. Their use was restricted to stock vaccinated against anthrax or being transported by motor vehicle.

Footrot

At the beginning of the year, five properties in the New England Protected Area were in quarantine because of virulent footrot caused by *Fusiformis nodosus*. During the year a further nine were quarantined following the detection of new outbreaks while nine holdings were released after the disease was considered to have been eradicated. Infection was successfully overcome by treatment alone in one flock, by treatment and slaughter of obstinate cases in two flocks and by the slaughter of all infected and in contact sheep in six flocks. Five properties remained in quarantine at the end of the year.

Of the nine new outbreaks, seven occurred between January and March when conditions were favourable for spread. Two of the fresh outbreaks were in large flocks that had been previously infected but from which the disease had been considered eradicated, in one case seven years previously and in the other four years previously. A carry over of infection from the previous outbreaks is considered likely, thus illustrating the difficulty of achieving complete eradication.

Elsewhere in the State, footrot was not a serious problem because of a dry spring. This prevented field appraisal of footrot vaccines. Towards the close of the year there was a slight upsurge in the incidence of the disease in the southwest.

Two outbreaks of *F. nodosus* infection in cattle were diagnosed.

Johne's Disease

Twelve cases of Johne's disease were confirmed, ten on two properties on the Far South Coast where the disease is enzootic and has been so on one of the properties for 27 years. The other two cases were on the Far North Coast. The disease is controlled by the destruction of affected cattle, and where females are affected, their last calf. Compensation is paid.

Information provided by the Victorian Department of Agriculture at the close of the year appeared to incriminate two properties in the southern part of N.S.W. as possible sources of infection. The matter is being investigated.

Salmonellosis

Salmonellosis occurred widely throughout the State causing mortalities in calves, pigs and poultry and to a lesser extent in sheep. Properties on which the septicaemic form of the disease occurs in cattle, sheep or pigs are quarantined for 30 days or until 7 days after the last death or evidence of symptoms, whichever is the longer.

The principal species isolated from calves was *Salmonella typhimurium*, but *S. singapore*, *S. dublin* and several other species were isolated to a lesser extent. In pigs, the main pathogens were *S. cholera-suis* and *S. typhimurium*, the latter also being most commonly isolated from sheep and poultry. *S. typhimurium* was more frequently found in pullorum reactors than during the previous year.

There was a wide variation in the resistance of isolates to antibiotics and sulphonamides. Those from sheep were 100 per cent resistant to erythromycin, those from cattle 71 per cent to sulphonamides and those from pigs 50 per cent to streptomycin. Other isolates showed lower but sometimes significant resistance.

Pullorum Disease

Only one confirmed outbreak of pullorum disease occurred in chickens. However, *Salmonella pullorum* was isolated from one consignment of moribund pullets and from one of seventy-six consignments of reactors.

Control of pullorum disease is maintained at two levels. A voluntary accredited flock scheme provides for class 1 flocks (free of infection) and class 2 (incidence of reactors up to 0.5 per cent). Compulsory testing applies to all other flocks from which chickens under three weeks of age or hatching eggs are sold. Testing is applied to maintain a reactor rate below 0.5 per cent.

The rapid whole blood stained antigen agglutination test is employed in the field. Where necessary to confirm infection, the serum plate agglutination test is used. Positive reactors are submitted to cultural examination.

A total of 1,026,269 birds were tested compared to 927,396 the previous year. In the accredited flock scheme, sixty-two flocks were tested compared with sixty-one last year, with a reactor rate of 0.02 per cent, double that of the previous year. Flocks under compulsory test decreased from twenty-three to thirteen, with a reactor level at 0.05 per cent compared with 0.03 per cent the previous year. The increase was due to a major breakdown in one flock.

The non-specific reactor rate was 0.01 per cent of all birds tested. This appeared due to both the antigen and infection with *S. typhimurium*, which was frequently isolated from pullorum reactors. An examination of four commercial antigens showed a variation in sensitivity. The results were used to evaluate antigens for registration.

Work was undertaken concerning a proposed international standard for reference sera as part of a World Health Organization project.

Regulations were introduced providing controls for pullorum disease in turkeys and ducks.

Marek's Disease

Under a new regulation, the manufacture and use of Marek's disease vaccine was made subject to control.

Exotic Diseases

Staff training programmes were undertaken to prepare officers to control a possible outbreak of an exotic disease. One senior veterinary research officer visited the United Kingdom to observe the diagnosis and control of swine vesicular disease. Plans have been prepared for the eradication of major exotic diseases and during the year those relating to swine fever and African swine fever were extensively revised and resubmitted to the Exotic Disease Subcommittee of the Commonwealth and States Veterinary Committee.

Detailed planning of eradication procedures is underway in conjunction with the State Emergency Services which are the co-ordinating authorities for national emergencies in N.S.W. and can invoke special powers when necessary.

Testing of Vaccines

Anthrax vaccines prepared by two manufacturers were tested. Low counts were recorded in some batches and these were considered due, in the case of one manufacturer, to the type of plastic bottles and containers being used.

ANIMAL HEALTH DIAGNOSTIC SERVICES

Mastitis

Many investigations were undertaken in dairy herds where the disease constituted a problem. Milk samples subjected to bacteriological examination from individual clinical cases of mastitis resulted in the recovery of *Staphylococcus aureus* from 31 per cent of samples, *Staph. epidermidis* from 17 per cent and *Streptococcus dysgalactae* from 5 per cent.

Milk samples were examined from all cows in fifteen herds where serious problems existed. *Staph. aureus* was isolated from 18.8 per cent of samples, *Streptococcus dysgalactae* from 3.6 per cent and *Streptococcus agalactiae* from 2.8 per cent.

Of the isolations from individual clinical cases, 36 per cent of *Staph. aureus* isolates were resistant to penicillin and 14 per cent to streptomycin. Of the *Strep. dysgalactiae* isolates, resistance was recorded to nitrofurazone and furazolidone in 11 per cent, to streptomycin in 11 per cent and to cloxacillin in 17 per cent. Of the herd isolates, 27 per cent of *Staph. aureus* were resistant to penicillin and 4 per cent to streptomycin.

Ephemeral Fever

During the summer and autumn, widespread sporadic cases confirmed by the serum neutralization test occurred throughout the northern half of the State. The highest incidence was in the Hunter Valley area where up to 25 per cent of properties became involved. However, only small numbers of cattle showed symptoms in any one herd. It is believed that spread was limited by a high level of immunity resulting from the severe 1969–70 outbreak.

Leptospirosis

The syndrome caused during the previous 2 years by *Leptospira hardjo* was only occasionally manifest, suggesting that the widespread clinical cases had occurred because of the introduction of the organism to a susceptible cattle population. Serological testing showed both *L. hardjo* and *L. pomona* to be widely distributed in cattle. The principal pathological effect of both organisms was abortion while *L. pomona* occasionally caused mortality in calves. A feature of the serological testing was a high incidence of titres of 1/100 to *L. hardjo* suggesting titres falling from a previously higher level.

In pigs, *L. pomona* was a significant cause of abortion while *L. tarassovi* was an occasional cause.

Bovine serum samples tested for this disease numbered 5,517 of which 1,105 were positive and 1,299 doubtful. Pig sera tested numbered 1,153 – 81 samples being positive and 58 doubtful.

Swine Erysipelas

Erysipelothrix insidiosa was isolated from fifteen mortalities and was suspected on serological and clinical grounds of being the cause of many others. Single isolations were made from separate pigs affected with chronic endocarditis, polyarthritis and weaner ill-thrift. The organism is suspected of being the cause of much of the widely prevalent polyarthritis.

Five outbreaks of abortion caused by the organism were diagnosed by serological testing.

Copper Deficiency

Hypocuprosis continued to be diagnosed in cattle throughout coastal districts with liver copper levels down to 5 ppm and plasma levels to 0.02 mg per 100 ml. The low liver levels were associated with all stages between extreme emaciation and no visibly detectable loss of condition. The disorder was also encountered in isolated herds in the central west.

Data are being obtained to define the soil, pasture and animal relationships between copper and molybdenum with consideration of calcium and phosphorus effects. Regular samplings of pasture and animals are being made from properties in different coastal areas. As much clinical hypocuprosis is associated with the top-dressing of pastures with molybdenum, laboratory findings are to be related to field studies to establish the extent to which molybdenum top-dressing is agronomically advantageous. Possible relationships with herd infertility are being investigated on eight properties.

Arising from investigations of possible pollution from a smelting works, copper deficiency was found in cattle in the vicinity. Whether this was induced by a pollutant or is an enzootic problem of the area has not been determined.

Cysticercosis and Echinococcosis

Specimens of *Cysticercus bovis* lesions detected at abattoirs and submitted for laboratory examination numbered 241. Cestode material, either scolex or calcareous corpuscles, was observed in only 35. Most of the remainder were considered to be degenerating cases. Lesions were mostly in the myocardium with some in the cheek muscles.

Whenever possible, the owners of stock, in the carcasses of which hydatid cysts were detected at abattoirs, were contacted. Their dogs were examined and advice on control measures tendered. Infected bovine carcasses were traced by their tail tags, but the tracing of sheep was almost impossible. A survey based on cattle killed at a coastal abattoir revealed cases from 354 properties representing 15 per cent of holdings in the district.

Infectious Bursal Disease

Following the isolation of the suspected virus of infectious bursal disease of poultry (Gumboro disease) by an industry veterinarian, samples of the infectious agent were forwarded to the Weybridge Central

Veterinary Laboratory, United Kingdom where the virus was confirmed as being that of infectious bursal disease. This represents the first diagnosis of this disease in Australia. The virus did not appear to be associated with any pathological condition in the flock from which isolated, but it was later suspected of causing weekly 0.5 per cent mortalities in two other flocks.

Laboratory Diagnostic Services

The number of specimens submitted to the Veterinary Research Station, Glenfield and the District Veterinary Laboratories, Armidale and Wollongbar, continued to increase, 18,148 consignments being received compared to 16,862 in 1971-2 and 13,713 in 1970-1.

Particulars of the consignments are shown in the accompanying tables.

Consignments of Specimens to Veterinary Laboratories

Class	Glenfield	Armidale	Wollongbar	Total
Cattle	8,695	2,715	2,066	13,476
Sheep	606	206	—	812
Poultry	1,248	109	19	1,376
Pigs	791	170	447	1,408
Horses	168	—	—	168
Other species	459	114	93	666
Plants	105	—	—	105
Miscellaneous	97	17	3	117
Total	12,169	3,331	2,628	18,128

Sources of Specimens to Veterinary Laboratories

Source	Glenfield	Armidale	Wollongbar	Total
Departmental officers	5,642	1,243	1,233	8,118
Veterinary inspectors	2,131	656	371	3,158
Veterinary practitioners	4,194	1,240	1,025	6,459
Others	202	192	19	413
Total	12,169	3,331	2,648	18,148

CATTLE TICK AND TICK FEVER CONTROL

Control of cattle ticks (*Boophilus microplus*) within the infested area in the northeast of the State is exercised by the Board of Tick Control under the jurisdiction of the Department of Agriculture. The infested country embraces a number of quarantine areas from and within which the movement of stock is controlled.

Eradication and Control Procedures

Kempsey area: In the Turner's Flat area where cattle ticks were detected the previous year, some 2,500 head of cattle were dipped at fortnightly intervals for 12 months followed by an 8 months programme of 21-day examinations. No cattle ticks were found in the area nor on other suspect properties in the district which had been constituted as individual quarantine areas and were subject to 21-day examinations and stock movement restrictions. Quarantine was therefore removed from all areas, which contained some 8,000 cattle on 72 holdings. The cost of the eradication measures over the 2 years had been approximately half a million dollars.

Boonoo Boonoo area: Some 10,000 head of cattle on 55 holdings were examined initially when mustered for station purposes and then from February to May in four examinations at 21-day intervals. No cattle ticks were found. The area was released from quarantine on 15th May.

Areas east of the Richmond Range: All stock except those in the Rappville section, received six dippings at 21-day intervals between spring and summer. In the Rappville section stock were subject to only four routine dippings because of a favourable tick history. The number of cattle dipped on each occasion was approximately 570,000.

Fifteen infestations were recorded compared to twenty-nine the previous year. Ten of the infestations occurred in the one locality and could not be classed as separate pockets of infestation.

Areas west of the Richmond Range: Four routine dippings were undertaken during the late summer and autumn. Seven infestations were detected, six being in the one locality and being linked. The number of infestations was the same as in 1971-2 but considerably less than the thirty-one detected in 1969-70.

In the Cullendore area, approximately 10,000 head of cattle on 43 holdings were examined when mustered for station purposes. It was decided to divide the area by a quarantine line and implement a policy of examining all musterable stock west of the line during the active tick season next year, with a view to releasing this portion of the area from quarantine.

Grafton area: Initial policy was to examine cattle on as many properties as possible. Following two detections of cattle ticks on cattle slaughtered at the Grafton abattoir, efforts were concentrated on suspect holdings. A total of 28,000 head of cattle on 870 out of 1,430 holdings in the area were examined. No cattle ticks were found. Investigations showed that one of the infestations detected at the abattoir possibly originated in abattoir paddocks, which, with the saleyards, were quarantined. The source of the other infestation was not determined.

Copmanhurst area: Stock numbering 61,709 on 227 out of 232 holdings were examined. Infestations, all linked, were detected on three properties. The origin was not ascertained.

Nambucca area: Following the detection of three cattle ticks on cattle slaughtered at the Macksville abattoir, traceback revealed light infestations on cattle on two properties in the district. Spread from one to the other was suspected. Following the finding, 6,700 head of cattle on 76 properties in the district were examined but no further infestations were detected.

Control of Infestations

Because all tick infestations detected in the past 2 years had been either found to be resistant to the common organophosphate acaricides or their status had not been determined, it was decided to regard all future infestations as resistant unless proved otherwise.

Of twenty-five infestations found in established quarantine areas, twenty-three were either proved to be of the Biarra resistant strain or strongly linked to other infestations with this strain. In the remaining two cases, the existence or otherwise of resistance was not determined.

The change in policy led to the formation of nine new special quarantine areas containing twenty-five infested properties and one abattoir area together with either the whole or part of seventy-six adjoining properties. Dips for the treatment of Biarra resistant strains were changed from Dursban ® to a mixture with 0.075 per cent ethion and 0.04 per cent chlorphenamidine.

Currumbin Valley, Queensland

To reduce the possibility of ticks being introduced into N.S.W. from the adjoining part of Queensland, a programme of voluntary dippings at twenty-one-day intervals was undertaken in the Currumbin Valley in conjunction with the Queensland Department of Primary Industries. Sixty properties were involved, of which sixteen were found infested. Stock on the latter holdings were treated at ten to fourteen-day intervals.

Inspections of Stock

Abattoirs: Examinations were continued of cattle arriving at the major abattoirs within tick quarantine areas and at three abattoirs in clean country. These examinations were intensified after detection of cattle ticks at Grafton and Macksville abattoirs.

Clean country: Some 11,000 head of cattle on 158 properties south of the Grafton and Copmanhurst areas and 25,000 cattle on 258 properties in the Kempsey district were examined but no cattle ticks were found.

Maintenance of Dips

Because most infestations were with Biarra resistant ticks, the acaricide in nearly 300 dips was changed from dioxathion to ethion. At the end of the year, 1,043 dips were charged with ethion, 289 with dioxathion, 70 with Dursban, ® one with carbaryl and one with ethyl bromophos. Chlorphenamidine was included in 324 ethion dips most of which were in areas adjoining that part of Queensland where the Mt. Alford strain of resistant ticks is present. Chlorphenamidine was also added to 13 dioxathion dips.

The method of analysing chlorphenamidine dip samples was improved while the method of topping up these dips was made more accurate. When the pH was kept below 5.5, chlorphenamidine remained stable and its concentration varied less than that of ethion.

Dipping Mortalities

The number of deaths in dipped stock considered due to organophosphate poisoning was 132. Treatment was given to 426 head, of which 80 died. The overall death rate was 3.1 per 100,000 dippings. Compensation amounting to \$8,881.35 was paid for the loss of 227 head of stock by death or injury.

Tick Fever

Babesia argentina infection was confirmed in a cow that died. Haemagglutination and transmission testing of cattle on the affected and adjoining properties revealed a *B. bigemina* carrier on the outbreak property. Ten months dipping of this holding was completed without further losses from tick fever and quarantine restrictions were removed after a negative herd test.

The two properties quarantined the previous year for this disease were released after completion of the dipping programme and testing of 1,678 head of cattle, on these and adjoining holdings. One carrier of *B. bigemina* was detected.

Eighteen head of Queensland stud cattle were tested for introduction to tick quarantine areas. One, which had been in N.S.W. for 6 years, was found infected with *Anaplasma marginale*. Negative haemagglutination tests were given by 184 head of N.S.W. bred cattle being tested for introduction to other tick quarantine areas from the Boonoo Boonoo and Cullendore areas.

Construction

Some 34 kilometres of new boundary fence were erected and 23 kilometres of existing fence repaired on the external and internal boundaries. Seven new dips were constructed and repairs effected to 383 dips and 139 dip yards.

There was a marked up-turn in building construction for staff accommodation, six-home modular panel units and three cabin units being erected. Fifteen aluminium demountable cabins were erected for temporary use.

Summary of Activities

	Cattle	Horses	Sheep/ Goats	Hides
Number of dippings	4,918,052	8,510	144	—
Number of sprayings	79,806	28,092	101	
Number of examinations	2,800,927	31,746	469	347,604

INTERSTATE STOCK MOVEMENTS

To prevent the introduction of cattle ticks (*Boophilus microplus*) to N.S.W., control is maintained on the introduction of livestock, plants, and animal products. For this purpose a staff of inspectors is maintained on the Queensland border. Stock entering from Queensland and dealt with by members of this staff included 690,787 cattle, 669,193 sheep, 10,777 pigs, 10,465 horses and 12,668 goats.

Some 9 km of new border fencing were erected, most in conjunction with the Darling Downs-Moreton Rabbit Board. Repairs and renovations were effected to eighteen staff cottages and two dip yards.

Restrictions were placed on the introduction of stock from two areas in Queensland in which cattle ticks were detected. Increased restrictions were placed on the introduction of grass seed, hay and other plant material from Queensland. Restrictions were introduced on the entry of stock by sea or air from Western Australia and Northern Territory.

ANIMAL QUARANTINE

Sections of the Quarantine Act relating to the importation of animals and animal products and the export of animals were administered on behalf of the Australian Government.

Animal Imports

A total prohibition remained on the importation of sheep, goats and birds. The ban on the importation of pigs and pig semen from the United Kingdom, was lifted but was almost immediately reimposed because of an outbreak of swine vesicular disease in that country. The ban on the importation of dogs, cats and horses by air from the United Kingdom was also removed.

A number of attempts to smuggle prohibited imports were detected, the largest single attempt involving 495 birds and 50 tortoises; 4 tortoises; 5 birds; 1 skunk; 100 dogs; and an oyster spat illegally arrived by air either having been overcarried from another country or were declared before or on arrival.

Prohibited species were found in eight regular fish consignments. Animals, birds and reptiles were found loose in the holds of six aircraft arriving from overseas.

Passengers Baggage

Co-operation with officers of the Australian Department of Customs and Excise continued in searching for illegal goods in the baggage of passengers arriving by sea and air. Principal seizures included 2 408 kg meat, 1 392 kg cheese, 1 254 kg trahana, 1,356 eggs, 32 used egg cartons, 173 animal skin drums, 77 Afghan coats and 443 other rawhide items.

Footwear and work clothes, brought by incoming air passengers who had been associated with rural industries in countries with foot and mouth disease were disinfected. Some 1,493 pairs of shoes were so treated and 11 clothing articles detained for laundering from 889 passengers.

Parcels Post

Liaison was maintained with customs officers to ensure the examination of all suspect parcels. A number of declarations regarding parcel contents were false as were a number of labels on tinned meats. Items seized included 664 kg meat, 94 kg cheese, 104 noodles, 133 eggs, 33 drums, 95 rawhide articles and 3 animal skin coats.

Ships Pets

Supervision of pets on overseas vessels while in port remained strict. On a number of occasions ships officers were instructed to tighten precautions against possible escape. Masters bonds were entered into on 297 occasions; 2 bonds were estreated; one because a ships dog was allowed uncontrolled on the wharf; and a second because a ships cat could not be accounted for. Four ships dogs and a bird were destroyed for various reasons.

Export of Animals

Control over the export of animals involved inspections, issue of health certificates and sometimes tests and supervision of treatment. Health certificates issued totalled 2,026.

MEAT INSPECTION

Meat inspection services were provided to thirty abattoirs, at which all stock were also inspected before slaughter. Meat inspection was further undertaken at one pet food knacker. All cattle and pigs offered for sale at Homebush saleyards were inspected.

Other activities included re-inspection of meat introduced into the Sydney metropolitan abattoir area, supervision of meat handling at the metropolitan meat markets and inspection of meat-carrying vehicles, smallgoods factories and retail butchers shops.

Carcasses and viscera of 1,887,975 cattle, 235,753 calves, 1,105,199 pigs and 10,131,369 sheep were inspected at abattoirs and 2,469 horse and 100 cattle carcasses at a knacker. Numbers of carcasses totally and partially condemned at abattoirs are shown in the accompanying table.

Carcass Condemnations

Cause	Cattle		Pigs		Sheep	
	Total	Partial	Total	Partial	Total	Partial
Abscess	12	2,219	3	10,151	6	—
Actinomycosis	56	30,536	—	—	—	—
Actinobacillosis	—	—	—	—	—	—
Arthritis	231	5,018	4,013	6,585	7,167	13,240
Cancer	1,935	13,666	55	—	1,815	—
Caseous	—	—	—	—	45,088	18,790
Lymphadenitis	—	—	—	—	—	—
Emaciation	610	—	95	—	26,753	—
Fever	500	—	308	—	5,613	—
Sarcosporidiosis	13	—	—	—	7,792	—
Other conditions	1,911	1,810	1,333	1,482	8,641	—
Total	5,268	53,249	5,807	18,218	102,875	32,030

The accompanying table shows the quantity of meat re-inspected after introduction into the Sydney metropolitan area from country areas of N.S.W. and other states.

Quantities of Introduced Meat Reinspected

Meat	From other states	From within N.S.W.
Beef carcasses (no.)	61 202	604 146
Beef pieces (kg)	3 442 909	3 326 858
Veal carcasses (no.)	64 934	118 794
Veal pieces (kg)	158 805	16 501
Mutton carcasses (no.)	463 383	4 019 368
Mutton pieces (kg)	1 260 629	2 529 875
Pork carcasses (no.)	74 891	558 837
Pork pieces (kg)	4 079 357	558 474
Bacon (kg)	1 347 602	61 601
Goat carcasses (no.)	—	20
Buffalo meat (kg)	1 932	—
Sundries (kg)	534 837	2 748 229

THE DAIRY INDUSTRY

Dairy Industry Act

Ninety-five dairy product factories were registered, five less than last year. Twenty-five annual inspections were made resulting in the issue of seven orders for structural and plant improvements. Registered dairy produce stores numbered one hundred and seventy, a decrease of twenty-two since the previous year resulting from rationalization of marketing or closure of business.

Examinations were conducted under the Act and certificates of competency issued as indicated in the accompanying table.

Certificates of Competency Issued under Dairy Industry Act

Subject	No. certificates
Milk grading — factory	16
— grader/driver	32
Cream grading	9
Milk testing	38
Cream testing	30
Cheesemaking	4
Buttermaking	8
Total	137

A correspondence course in buttermaking was prepared for use by the Department of Technical Education.

Dairy Detergent Advisory Scheme

The N.S.W. Dairy Detergent Advisory Scheme was initiated in January by the publication of an introductory information bulletin. The scheme aims to promote the testing of dairy detergents and sanitizers at the Commonwealth Advisory Laboratory on Dairy Detergents and Sanitizers and to upgrade these products by the publication of lists of those found satisfactory.

The first bulletin of results was widely publicized and included one sodium hypochlorite, four iodophors and four heavy duty alkaline detergents as satisfactory products. Manufacturers of products found unsatisfactory were privately advised. Further samples are undergoing evaluation.

A quality control operation was also established whereby six officers will purchase off-the-shelf samples of products on the satisfactory list at six monthly intervals for laboratory evaluation. Each sample must pass all tests for the product to remain on the list. This scheme is already resulting in a general upgrading of the quality of dairy detergents and sanitizers.

Dairy Herd Improvement Programme

This programme combines herd recording and artificial breeding and replaces the former Herd Production Improvement Scheme.

Official herd recording section: The expansion evident in recent years continued with 366 herds and 14,128 cows being recorded, an increase of 14 herds and 1,397 cows over the record number achieved in the previous year. The average production per cow also continued to rise. The 12,858 cows which completed normal lactations yielded an average of 4,279 kg milk, 4.0 per cent butterfat and 169 kg butterfat. The butterfat yield was the same as the previous year but the milk yield was higher by 67 kg.

Group herd recording section: Cows recorded numbered 89,257 from 1,484 herds of which 79,036 cows completed normal lactations and averaged 3 174 kg milk, 4.0 per cent test and 128 kg butterfat. This is the highest production ever achieved in this section.

Production for the three highest producing districts is shown in the accompanying table.

District Averages for Principal Districts

District	No. of Cows	Milk kg	Butterfat %	Butterfat kg
Muswellbrook	8,158	4 033	3.76	151.5
Nowra	11,147	3 879	3.82	148.3
Windsor	7,103	3 899	3.68	143.3

Demand for service: Increased demand was evident particularly where milk quotas previously existed or where new quotas had been issued. Additional units are being organized in three districts to commence in the new recording year.

This increase was partly offset by a decline in demand on the Far North Coast. However there was a net increase of seventeen herds.

Optical character reader: During 1971-2, the optical character reader (OCR) was examined to test its usefulness in data input to the computer and proved most successful. Steps were, therefore, taken to convert the whole of both sections of the herd recording scheme to the use of the OCR.

The change was not radical for the official section but was so for the group section which had previously been processed by the recorder in the field and only the final lactation figures taken to computer. The change is expected to relieve part of the recorders work load and greatly improve accuracy.

Rule changes: The processing of records on a sample rather than a lactation basis enabled rule changes which have greatly simplified the organization and administration of the herd recording scheme in the field.

Previously the Department was bound to sample farmers milk every 25 to 35 days but the use of the computer and OCR system now allow sampling to be done between 20 and 70 days after the previous visit.

This flexibility and the element of surprise thus made possible enabled changes to be made to the methods of check recording in the official section and of providing relief when recorders are absent. It also allowed changes to the system of averaging abnormal records so that much greater use could be made of the computer. Because it was, thus, necessary to rewrite many rules, the opportunity was taken to revise the full set of rules.

Register of merit: This was abandoned after discussions with the Registered Dairy Cattle Association who were agreeable provided the Department could arrange for the total lifetime production of the cows recorded in the official section to be calculated. This was carried out through the computer and lifetime figures were added to the lactation statements produced as from May.

Standard production certificate: The method of preparation was changed from a handwritten certificate from computer print-out material to a computer print on the lactation statement when applicable.

Identification of cattle: Use of flexible type ear tags, provided at cost to participating farmers, significantly improved the identification of cattle under test and heifer calves being raised.

Artificial breeding: The N.S.W. Dairy Industry Authority Act requires the Artificial Breeding Advisory Board to co-ordinate the artificial breeding service of the Dairy Industry Authority with the Department of Agriculture's herd recording scheme. A two-member committee representing both bodies was formed for this purpose. An extension campaign was conducted to promote the co-ordinated Dairy Herd Improvement Programme.

The system of contract mating to obtain the most suitable young bulls for artificial breeding was accepted by the Artificial Breeding Advisory Board. The Department's responsibility is to identify females considered to be sufficiently superior to the population average to warrant special contract mating. Cows of the A.I.S., Guernsey and Friesian breeds were selected.

To supply an incentive for farmers to participate in the combined artificial breeding-herd recording scheme, provision was made for the recording of daughters of young bulls in the artificial breeding programme.

Quality Control

Grading services: Dairy produce graders regularly examined butter and cheese manufactured in N.S.W. before being stored, distributed for local sale or consigned interstate. Details of the gradings were supplied to distributing agents, factory managers and district dairy officers. The information was also used for the Order of Merit of the N.S.W. Department of Agriculture and the continuous grading competitions at the Royal Agricultural Society's Show and the North Coast National Exhibition.

Butteroil, ghee, dried milk products, cottage cheese and yoghurt were examined and reported on when requested by manufacturers or distributors.

Milk quality: Whiteside tests were carried out monthly at most factories and generally gave improved results compared to the previous year. Yellow staining of sediment pads, resulting in downgrading of milk caused concern in some districts.

Low solids-not-fat was frequently due to poor nutrition and could be overcome by supplementary feeding.

Butter quality: Some 1,192 samples were examined for 5 different microbiological counts. The improvement in quality continued, with the percentage of samples satisfactory on all counts being the highest since the total count standard was lowered in 1968.

To survey the quality of retail print butter in country areas, eighty-seven samples were purchased in different centres and sent for organoleptic evaluation and microbiological examination. Although the proportion of satisfactory samples improved since the previous survey, quality was not as good as that of bulk butter. Several microbiological surveys of butter processing plants were carried out, samples being taken from each stage of the processing. The results indicated areas where improvement could be made in the cleaning and sanitizing of equipment, and in the hygiene of factory personnel.

Cheese quality: Examinations were performed on 147 samples representing every factory in N.S.W., for *Escherichia coli* and staphylococci. Overall quality remained about the same as last year. Staphylococcal counts improved while those of *E. coli* worsened. A major factor contributing to this situation was the regular sampling of small fancy cheese manufacturers. Quality problems were investigated in several factories. Analyses of milk, whey, rennet, salt and water samples were carried out to determine possible sources of contamination.

Several conferences were held with manufacturers in an attempt to improve quality. The industry agreed to a quality assurance plan whereby poor quality cheese is withheld from the market until its bacteriological and chemical composition is determined.

As a further check on quality, a survey of cheese purchased in retail stores was begun. Examination of 100 samples showed that quality was fair, with undesirable bacteria being found primarily in soft varieties.

Starter Cultures

Starter cultures for the manufacture of cheese, yoghurt and other cultured milk products were supplied to dairy factories in N.S.W. mostly in freeze-dried form in glass ampoules. Assistance was given to factories developing new cultured products. Enquiries for cultures to make yoghurt and cheese at home increased.

Cultures were also supplied to factories for use in testing for antibiotics and other inhibitory substances in milk products.

NOXIOUS ANIMALS AND INSECTS

Rabbits

Rabbit control is administered by the Department of Agriculture and organized by Pastures Protection Boards. Methods used consisted of poison baits, the liberation of myxoma virus and trapping.

Sodium fluoroacetate (1080) was the commonly used poison. Myxoma virus was produced at the Veterinary Research Station, Glenfield, which supplied 102,780 rabbit doses to Pastures Protection Boards and owners in N.S.W., and 6,300 doses to the Australian Capital Territory and other States.

As a result of these measures 11,500 properties comprising 8 million hectares in the central and eastern divisions and 236 properties covering 1 million hectares in the Far West are considered free of rabbits. Nine Pastures Protection Boards have established rabbit-free areas embracing 1,196 properties and 300 000 hectares.

Training in rabbit control was provided for Pastures Protection Board staff.

Plague Locust Control

During the spring, control treatments by landholders against the plague locust (*Chortoicetes terminifera*), were required in several areas. As a result of migration from Queensland, infestations developed extensively in the Western Division. Large numbers of locusts also appeared in areas previously relatively free. In the southwest, infested districts included Narrandera, Hillston, Balranald, Hay, Moulamein and Deniliquin. In the northwest, locusts appeared between Warialda and Narrabri and in the Tamworth District and in the Central West between Pilliga, Nyngan and Dubbo.

The Department co-operated with Pastures Protection Boards by providing advisory staff at seminars and field-days and technical supervision where departmental misting equipment was in use. Large quantities of lindane were distributed throughout the State for landholders use.

Ground control was simplified with the provision of radio transceivers to vehicles, and spray plants. The Department also provided a co-ordinating service through its centres in Narrabri and Hay, where departmental staff maintained the necessary planning, telex and radio facilities.

Extensive aerial spraying, using either fenitrothion or maldison, was carried out during the spring in the Riverina and Western Division. At least 200 large migrating swarms of locusts were treated and the campaign satisfactorily concluded in December.

MISCELLANEOUS LEGISLATION

Cattle Compensation Act

Claims approved for payment totalled 10,651, being 5,929 less than approved during 1971-2. Compensation was paid for 14,893 cattle ordered to be destroyed on account of suspected disease and 827 carcasses condemned during meat inspection.

Particulars of the diseases on which claims were paid are set out in the accompanying table.

Disease	Claims No.	Animals No.	Payment
			\$
Tuberculosis	350	870	67,698.00
Cancer	7,475	11,506	544,405.73
Actinomycosis	2,126	2,512	94,340.10
Actinobacillosis	692	814	32,265.11
Pleuropneumonia contagiosa	1	5*	199.47
Bovine tick fever	3	8	461.38
Johne's Disease	4	5	621.27
Total	10,651	15,720	\$739,991.06

* not affected with pleuropneumonia contagiosa.

The following table shows the number of claims disallowed and the reasons for disallowance:

Delayed notification of disease	373
Failure to notify disease	53
Non-payment of compensation levy	10
Failure to lodge stock return	18
Late application for compensation	2
Carcass not condemned by meat inspector	2

In addition, the compensation payable was reduced for 100 claims on account of delayed application

Swine Compensation Act

Claims paid for pigs ordered to be destroyed on account of suspected disease and carcasses condemned during meat inspection were as shown in the accompanying table.

Diseases	No. of claims	No. of pigs
Tuberculosis	21	34
Septicaemia	94	143

Stock (Artificial Insemination) Act

One centre and four subcentres were licenced during the year to bring the total number of centres to six, two operated by the Dairy Industry Authority and four privately.

Bulls intended for centres were tested for disease on the properties from which they were being purchased, again at an admission centre external to the artificial breeding centre and finally in an isolation centre within the artificial breeding centre. In addition, annual tests were performed.

Bulls were tested for tuberculosis, brucellosis (serum agglutination test and complement fixation test), leptospirosis (*L. pomona*, *L. hardjo*, *L. tarassovi*, *L. icterohaemorrhagiae* and *L. grippotyphosa*), contagious bovine pleuropneumonia, Johne's disease, Q-fever, ephemeral fever and infectious bovine rhinotracheitis — infectious pustular vulvovaginitis (IBR-IPV). Preputial samples were cultured for *Trichomonas foetus* and *Vibrio foetus*, and also examined for the latter disease by the fluorescent antibody test.

The number of bull tests performed included: on farms — 40; at admission centres — 44; at isolation centres — 60; and in annual tests — 140.

Six bulls were rejected, one on clinical grounds, three due to reactions to the ephemeral fever test and two because of brucellosis reactions.

Export of bull semen greatly increased, necessitating considerable testing of bulls. For instance, the United States required bulls supplying semen to be tested monthly for ephemeral fever. A survey of the IBR-IPV status of bulls in centres showed the prevalence of the disease to be high in one centre.

Certificates of competency were issued to thirty-nine persons for the insemination of cows and to four persons for the collection, appraisal, dilution, storage and packaging of semen.

Stock Foods and Medicines Act

Registration was granted to 1,635 stockfoods. As in previous years, manufacturers were required to supply particulars of feed additives which could cause residues in carcasses or animal products. Analysis of 105 stockfeed samples showed that 15 were deficient in protein, 25 contained excess fat, 26 were deficient in fat, 23 had excess fibre while 16 showed gross variations in the urea content from that declared. Dog foods and those containing urea were proportionately the greatest offenders. Of 185 samples examined for weed seeds, 129 did not conform to requirements. Regulations were introduced prohibiting stock feeds from containing more than 20 parts per million (ppm) of dichlorvos and fenitrothion and more than 125 ppm of methyl bromide.

The Stock Medicines Board examined 2,075 applications for registration, of which 1,535 re-applications and 362 concerning new preparations were approved; 4 products were refused registration. Consideration of the balance was deferred. A protocol for determining the excretion end points of antibiotics formulated for mastitis was finalized for the Technical Committee on Veterinary Drugs. The selling or the attempted selling of 39 unregistered stock foods and 17 unregistered stock medicines was detected.

Poultry Processing Act

Three poultry inspectors conducted 1,457 assessments in the 74 registered plants where chickens, turkeys, ducks and boiling fowls are processed. No prosecutions were made. The Act requires that the amount of water absorbed by carcasses during processing shall not exceed an average of 8 per cent based on the results of 20 carcasses in each assessment. It also stipulates that the labels on packages containing chicken carcasses must indicate whether or not giblets are present.

Poultry inspectors commenced a survey of construction and operational standards of all registered plants.

Prosecutions

Sixty-two successful prosecutions were undertaken, fifty-two being under the Stock Diseases Act. Most of the latter were for breaches of the section of the Act requiring cattle being sold to bear tail tags. Thirty-two owners were prosecuted on this account. One prosecution was for the illegal introduction of a bull to N.S.W. and nineteen were for offences in connection with sheep lice, principally attempting to sell lice infested sheep, failure to notify the presence of sheep lice, being the owner of lice infested sheep found straying, moving infested sheep along a public road and failure to notify shearing in the Western Division.

Seven prosecutions were instituted under the Veterinary Surgeons Act. Veterinarians were prosecuted for illegal advertising, for distributing visiting cards to persons other than clients and for performing veterinary work in New South Wales while not being registered. A lay person was prosecuted for the illegal practice of veterinary science and two lay persons for vaccinating dogs against distemper. One lay person was prosecuted for using letters indicating veterinary qualifications.

Under the Swine Branding Act, two persons were prosecuted for selling unbranded pigs. One person was prosecuted under the Quarantine Act for the importation of prohibited canned meat.

PESTICIDE RESIDUE CONTROL

Liaison was maintained with the Egg Marketing Board in relation to organochlorine residues in eggs, which showed a considerable fall and were mostly below the tolerance level. Experiments showed that the use of DDT contaminated rice hulls for deep litter could entail significant residues. Lower DDT residues were found in cottonseed hulls.

As a part of a programme to monitor the efficacy of testing methods for hexachlorobenzene residues, the Australian Department of Primary Industry was supplied with fat samples of sheep which were on a controlled intake of this pesticide.

Significant levels of cadmium, copper, lead and zinc were found in the tissues of cattle grazing areas in the vicinity of a smelting works. Surveys were undertaken to relate the levels in the tissues with distances from the works.

Because of the discovery of polychlorinated biphenol residues in fish in neighbouring countries, imported samples of fishmeal were examined for the presence of this chemical. The findings were negative.

APICULTURE

Livestock officers (apiculture) enforced the Apiary Act to prevent the spread of serious bee diseases, particularly American foul brood disease caused by *Bacillus larvae*. There were 33 outbreaks necessitating the destruction of 344 hives. In accordance with policy since 1946, *ex gratia* compensation payments amounting to two-thirds the value of the material destroyed, were made to owners.

For the export of bees, honey and other apiary products to other States and overseas, apiaries were inspected and appropriate certificates issued. Assistance was given to the Quarantine Section regarding imported bees.

MISCELLANEOUS SERVICES

Fleece Measurement Service

The Fleece Measurement Service has been provided, with financial support from the Wool Research Trust Fund, to enable ram breeders to select breeding stock of genetic merit. During the year 4,705 wool samples from 82 studs were examined. The figures represent a 40 per cent increase in sample numbers and a 32 per cent increase in participating studs on the figures of the previous year. A feature was that a request was made for fibre diameter measurements with all samples. This contrasts with the situation 10 years ago when this measurement was sought for only 1 per cent of samples.

A survey among participating studs showed that only 8 per cent submitted wool samples from all rams. Samples were from an average of only 37 per cent of rams in these studs.

The service was terminated as from June, 1973. Instead, an advisory service is to be provided to assist producers in the implementation of objective measurement in wool marketing and the genetic selection of breeding stock.

Sheep Fertility Service

The Sheep Fertility Service investigated problems in thirty-nine flocks. Two three-man units supported financially by the Australian Meat Research Committee and the Wool Research Trust Fund were

restructured to provide three two-man teams to service the southern, central and northern parts of the State.

Margarine Manufacture

All six margarine factories operating in the State were inspected.

Drought Relief

Such was the extent of drought, that out of fifty-nine pastures protection districts and the Australian Capital Territory (A.C.T.), the latter and three districts were declared drought-stricken for the full year and fifty districts for part of the year, so that stockowners therein could be eligible for freight rebates on introduced fodder or the carriage of stock to and from agistment. At the peak of the drought in September, the A.C.T. and forty-six pastures protection districts were declared drought-stricken.

Because of the seriousness of the situation, freight concessions applicable to rail were increased in amount and extended to include the transportation of fodder and stock by road, and for the first time were made applicable to interstate movements. The Drought Loans Scheme was also reintroduced to assist owners purchase feed during drought and restockers at the end of the drought.

Travelling Stock Reserves

Field officers completed two general reviews of travelling stock reserves held by Pastures Protection Boards. Six such reviews have been completed since 1966. In the last two surveys more than 45,000 acres of surplus reserves were recommended for disposal by the Department of Lands.

Public Watering Places

Maintenance and improvement of public watering places in the Western Division continued at a rate similar to previous years with an expenditure of approximately \$100,000. Most major stock routes in this area are now provided with watering facilities strategically located approximately every 20 kilometres.

Brands and Earmarks

New applications for the allotment of cattle and horse brands totalled 1,153. Brands numbering 585 were transferred from one proprietor to another.

Sheep earmark transfers and original applications totalled 922, colour brand transfers and new applications totalled 718 and there were five applications for transfer of a sheep firebrand.

Swine brands allotted were 927, transfers were 455 while 13 licences were issued. A total of 1,544 swine brands were cancelled.

Tail Tags

Allotments to owners were made of 5,143 new tail tag numbers, as required for the identification of sale cattle for disease control purposes. Numbers re-allotted totalled 1,133 while 35 were cancelled; 53 applications for exemption from the use of tail tags were granted.

6.3 MARKETING SERVICES AND SERVICES TO OTHER ORGANIZATIONS

MARKETING REPORTS AND RELATED SERVICES

Reporting of Prices and Supplies of Primary Produce

The Division of Marketing and Economics continued to collect and disseminate wholesale market information as required under the Marketing of Primary Products Act, 1927.

Reports covering daily supplies, quality, and prices were prepared for the following wholesale markets; City Municipal Markets (fruit, vegetables, poultry, fish and cut flowers), Homebush livestock market (cattle, sheep and pigs), and the Alexandria and Perry Park selling centres (grain, forage and hard vegetables). The retail prices of certain commodities were also reported on daily.

This information was broadcast daily by the Australian Broadcasting Commission (including regional relays and interstate hook-ups) and by some city and commercial radio stations and TV channels. The daily press, periodicals, Commonwealth and State government departments and instrumentalities, and producer organizations, were supplied with detailed marketing information through the *Daily Wholesale Price Quotations*.

Following a request from the ABC, comments by markets officers on livestock sales have, since April, 1973, been video-taped weekly and televised later the same day over its TV programme "Landline".

Publication of the *Weekly Marketing Notes* continued. This summarizes weekly activities in all local markets and includes a synopsis of prices and trends.

Monthly surveys of the wholesale and retail prices of various stockfeeds and the wholesale prices of dressed poultry were continued.

The Division continued to record and publish statistics of apples and pears held in cool and controlled atmosphere storages throughout New South Wales.

Records of selected arrivals into Sydney by rail, air and ship of various primary products from interstate and intrastate sources, were maintained.

Numerous requests were received from State and Commonwealth government departments, banks and private individuals (in Australia and overseas) for information about prices and prospective markets for a range of primary products.

Monthly reports on prices and trends in pig production for the major centres throughout the State were supplied by the Division of Animal Industry to pig-breeders societies, associations, banks, and the Bureau of Agricultural Economics. Information on trends in wool and lamb were furnished to the Bureau of Agricultural Economics and the State Lamb Committee.

Crop and Livestock Reviews and Forecasts

The regular annual acreage estimates and production forecasts were prepared for wheat, oats, and barley crops, as well as production estimates for oranges, lemons, mandarins, and grapefruit.

Publication of the monthly *Report on Production Trends* continued. This contains a summary of seasonal conditions and production prospects for the more important grain, oilseed and potato crops of New South Wales; monthly slaughtering and production figures for livestock; production figures for dairy products and eggs; and wool receivals and sales.

Publication of the monthly *New South Wales Pastoral Conditions* also continued. This includes a survey of seasonal conditions, the pasture and feed situation, and condition of livestock.

Brief special reports on seasonal conditions and crop prospects were supplied each month for the Department of Overseas Trade, Sydney, and the Bureau of Agricultural Economics, Canberra.

Commodity Information

During the year, the production of a new monthly publication, the *Commodity Bulletin* was commenced by the Division of Marketing and Economics. These bulletins include articles dealing with the market situation and outlook for crops and livestock products, and also special articles on specific commodities.

SERVICES TO OTHER DEPARTMENTS AND ORGANIZATIONS

This Department provides a significant and fairly comprehensive range of services to other departments and organizations, the details of which would be too numerous to list individually. The following are an example of the range of services provided.

Division of Animal Industry

Veterinary attention (a total of 117 services) was given to stock owned by, or under offer of sale to, the Departments of Child Welfare and Social Welfare, Education, Corrective Services, Health, the Dairy Industry Authority, the Lord Howe Island Board, the Police Department, CSIRO and the Queensland Department of Primary Industries.

Advice on livestock husbandry was provided to the Departments of Child Welfare and Social Welfare, Corrective Services, Health, Education, Lands, and the Maritime Services Board.

Assistance in the selection of sheep for Colombo Plan Projects in India and Korea, and advice in the administration of the projects, was given to the Department of Foreign Affairs.

Pigs for research purposes were supplied to the Childrens Medical Research Foundation, University of Sydney, and the CSIRO.

The CSIRO was assisted in the selection of properties for research projects.

Division of Dairying

The division administered the Commonwealth Advisory Laboratory on Dairy Detergents and Sanitizers and supplied analytical data on samples submitted by State Departments of Agriculture and detergent and sanitizer firms.

Information was supplied through the Dairy Herd Improvement Programme to the Artificial Breeding Centre, Berry, on bull dams for contract mating and proofs on young bulls used in artificial breeding.

Dairy livestock were supplied to Hurlstone Agricultural High School, the Department of Child Welfare and Social Welfare, and to the Society of Those Who Have Less (for use in India).

Division of Horticulture

Assistance was provided to the Sydney Farm Produce Market Authority in relation to various packaging investigations and the development of the new markets at Flemington.

Advice was given to the Rural Assistance Board on the implementation of the Australian Government's Tree Pull Assistance Scheme. Country officers have undertaken inspections in connection with applications received by the Board.

The State Treasury was assisted in the assessment of the effects of hail and excessive rain and wind upon fruit crops for purposes of financial assistance to growers.

The Lands Department and the N.S.W. Water Conservation and Irrigation Commission were assisted in relation to advice concerning the installation of irrigation systems and problems arising with respect to land use.

Division of Plant Industry

Inspections were carried out and reports prepared in relation to 125 loan applications under the Farm Water Supplies Act, for the N.S.W. Water Conservation and Irrigation Commission.

Co-operation was given to the Commonwealth/State Committee planning Sydney airports in the inspection and assessment of sites.

Inspections were carried out and reports prepared in relation to damage caused to agricultural land during operations of employees of other departments and instrumentalities to assist in settlement of compensation claims.

Twenty-nine inspections were carried out under section 48 of the Mining Act on behalf of the Department of Mines to assess land classifications where applications for entry to prospect or mine were disputed by landholders.

Biological and Chemical Research Institute

Co-operation was given to the Forestry Commission of New South Wales in monitoring the spread of poplar rust disease in the State.

The Department of Primary Industry, Canberra, was supplied with 200 reports of analyses of stock foods to assist with the compilation of tables of the average composition of Australian stock foodstuffs.

A chemist from the institute spent several weeks in New Guinea as a member of a team of Australian scientists investigating the incidence of dental caries in the indigenous population, for the World Health Organization.

Representative wheat samples collected by the Atomic Weapons Tests Safety Committee were milled on their behalf.

Water analyses reports on underground waters were supplied to the Mines Department. Analyses of fish feeds in relation to trout and salmon nutrition were undertaken for the Fisheries Department.

Analyses of water samples from Sydney Harbour, in relation to marine weed growth, were provided for the Maritime Service Board.

Various departments, local government bodies, and other organizations were provided with services in connection with: Argentine ant eradication; plague locust; clearance of agricultural chemicals for registration; fresh fruit disinfestation; fruit fly investigations and suppression campaigns; grain pests investigations; insecticide resistance; insects of importance to public health; toxicity of insecticides; insect identification (quarantine); parasite liberations; and pest management investigations.

Biometrical Branch

Advice on statistical matters and on computing was given to personnel of the Chief Secretary's Department, the Bureau of Crime Statistics, the Forestry Commission of N.S.W., the Departments of Health, Environment, and Soil Conservation, and the Australian Meat Board.

Royal Botanic Gardens and National Herbarium

The Police Department and Department of Customs and Excise were assisted with information and identifications concerning drug plants, prohibited imports and plant material forming evidence in criminal cases.

A report was prepared for the Lord Howe Island Board on the palm seed industry on Lord Howe Island.

Algal identifications were provided for university and Fisheries Department staff for ecological studies on several marine and estuarine sites.

Plant specimens and seed were supplied to other botanical institutions in Australia and overseas as part of regular exchange programmes and in response to requests arising from research studies.

Various government authorities were provided with technical guidance in horticultural and landscape development works and with assessment of staff and selection and purchase of specialized park maintenance equipment.

Plant material for decorative effect in Government offices and Government exhibitions of various kinds was provided, but not without making heavy inroads into the normal functions of the institution which is a unit of scientific investigation and display.

6.4 GARDENS, DOMAINS AND PARKS

ROYAL BOTANIC GARDENS

The Gardens were maintained in satisfactory condition with attractive seasonal displays being a feature of both outdoor and glasshouse areas. Consistently high summer temperatures during the Christmas–New Year holiday period followed by 35.7 cm of rain over 19 days in February caused considerable damage to the turf demonstration plots of *Agrostis* (Bent Grass), *Festuca* and *Poa* selections necessitating complete renovation and replanting. The excessive rain also caused flooding of the lower Gardens and seriously disrupted maintenance and development works.

The institution of an educational programme is a new development and since an education officer has been available on secondment from the Department of Education, increasing interest is being shown by schools and the general public in the potentialities of the Gardens and associated areas in this direction. Continued development of this programme is planned and certain areas are being reorganized with educational themes in mind. Consultation and co-ordination of work between the botanical and horticultural staff have been considerably increased for this purpose.

Improvements Effectuated

Extensive replanting of the Nellie Stewart Memorial Rose Garden was undertaken with new and recently introduced varieties to increase public interest. Similar progressive replacement of portion of the planting is proposed each year to increase its educational value. Ornamental plantings generally were extended by the placement for public exhibition of some 1,000 trees and shrub species throughout the grounds, and consolidation of several shrubberies was undertaken. Lawns throughout the Gardens have been renovated and restyled or reseeded where necessary with noticeable improvement in the overall aesthetic effect.

Plant Production and Glasshouses

The range and quantity of material under production has been further increased during the year in consequence of the continuing close liaison maintained with kindred institutions in Australia and overseas as well as with specialist plant societies and individuals. In the glasshouses many effective displays of flowering and foliage plants were staged during the year, but considerable difficulty has been experienced in maintaining a satisfactory standard of presentation due to the general condition of the houses and certain associated services. Construction of the new pyramidal exhibition glasshouse with internal elevated viewing platform is almost complete and when open to the public it will provide much needed improvement to this section. However, providing space for expanding collections remains a problem. Plants and floral decorations continued to be provided for Parliament House and Government exhibits as did the supply and maintenance of decorative material to certain Government offices.

Landscape Designing and Associated Services

External: The Landscape Design Section inspected and where appropriate prepared reports and plans for the Glenfield Veterinary Research Station; Seven Hills Poultry Research Station; Sydney Farm Produce Market Authority's New Markets, Flemington; Point Frederick Cemetery; Gosford Shire Council; Conservatorium of Music; Yagoona Public School; Prince Henry Hospital; Sewerage Development, Department of Public Works, Blaxland; Tree Preservation, Commonwealth Department of Works; proposed Botanic Garden, Maitland City Council.

Internal: Apart from directing landscape works associated with general development of the Royal Botanic Gardens and Domains and with the restoration and development of Centennial Park, officers of this section were heavily committed to programming and the general oversight of special works being performed under the Metropolitan Unemployment Relief Programme.

Principal internal projects comprise further replanning of the middle garden area with educational themes in mind, working drawings for the new succulent and cacti garden, extension of tree and shrub plantings in all areas, redevelopment of the children's playground at Centennial Park and preparation of preliminary plans and reports for landscape development in the Royal Botanic Gardens adjacent to the Sydney Opera House.

THE DOMAINS

The Inner and Outer Domains were satisfactorily maintained and a number of improvements effected. These included replanting of the large shrubberies along Macquarie Street in the Palace Garden, planting of the newly landscaped area adjacent to the Library of N.S.W., further reseeded and turfing of denuded areas, removal of redundant rockeries and miscellaneous tree species lacking in vigour, regrading and turfing of exposed areas and construction of stained timber fencing as a surround to the works depot adjoining historic Domain Lodge. Much of this work was made possible by the manpower

available under the Metropolitan Unemployment Relief Programme. Liaison continued with contractors engaged on construction of the Eastern Suburbs Railway in order to minimize public inconvenience and damage to Domain lands.

The Domain was again used for recurrent annual parades and assemblages associated with events of civic and national significance as well as by the traditional public orators on Sunday afternoons. Areas made available for the now long established lunchtime winter sporting fixtures received maximum possible use.

GOVERNMENT HOUSE

Inner Domain staff continued to maintain the grounds and provide interior floral services for Government House. Further discussions with His Excellency the Governor and Lady Cutler relative to proposed landscaping for the forthcoming Royal Visit were well received.

ADMIRALTY HOUSE

Royal Botanic Gardens staff satisfactorily maintained the grounds of Admiralty House, the Governor-General's Sydney residence, and provided internal floral decorations for the building and for Government House, Canberra.

CENTENNIAL PARK

Restoration and improvement of Centennial Park continued, including desilting of ponds and reformation and grassing of associated embankments and clearing of unwanted undergrowth from the South West Area as a preliminary to its development as an arboretum and habitat for wildlife. The former sanctuary in the central area of the park adjacent to Lachlan Reserve was also cleared of unwanted exotic vegetation and placed under restricted public access to enable desirable regeneration of natural species. Other areas have been improved by further extension of tree plantings, further installation of seating and litter bins of modern design, road construction and kerbing and repainting of fencing.

Interest in and demand by all age groups for the facilities provided in Centennial Park continued to increase. The Jervois Avenue entrance to the park has been widened to facilitate vehicular and pedestrian entry and exit whilst the works depot complex has been further extended by construction of an additional machinery shed.

MT TOMAH ANNEXE

Funds for capital improvement to this 32-hectare annexe continued to be unavailable. However, in consequence of the continued programme of Rural Unemployment Relief further site clearing and associated work has been undertaken and the planting of ornamental nursery stock in the holding area expanded. A large number of young trees and shrubs are being grown in the holding nursery in preparation for planting out when clearing and construction of paths, etc., have progressed to a suitable stage. The annexe will feature plants of temperate regions of both northern and southern hemispheres and should serve both as a display garden and as an educational resource. Installation of an irrigation pumping unit has improved the system of water supply. Plans for construction of a cottage for a resident officer are in preparation.

APPENDIX I

ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1972-3

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings and permanent improvements to departmentally owned property is a charge on the General Loan Account.

In addition to those sources of funds, the Department is assisted in financing certain lines of research and development, together with the control of insect pests and animal diseases, by levies on industry and by grants from the Commonwealth, semi-Governmental and public and private organizations. Operations in this category are reflected in a large number of accounts within the classification of Special Deposits accounts. The operations on some of the more significant special deposit accounts are detailed later in this report.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1971-2	1972-3	Increase
	\$	\$	\$
Consolidated Revenue Fund	23,797,174	26,117,307	2,320,133
General Loan Account	1,435,000	1,525,000	90,000
Special Deposits Accounts	15,418,807	17,514,245	2,095,438
	40,650,981	45,156,552	4,505,571

CONSOLIDATED REVENUE FUND EXPENDITURE

Division	1971-2	1972-3	Increase (Decrease)
	\$	\$	\$
Central Administration	4,019,251	3,882,636	(136,615)
Biological and Chemical Research Institute	1,045,382	1,169,246	123,864
Plant Industry	1,248,481	1,373,374	124,893
Horticulture	1,357,116	1,494,497	137,381
Dairying (a)	1,613,109	1,411,226	(201,883)
Research Stations	2,087,488	2,743,970	656,482
Agricultural Colleges	3,344,712	3,961,210	616,498
Animal Industry --			
Head and District Offices (b)	4,334,468	4,948,277	613,809
Queensland Border	414,872	386,121	(28,751)
Tick Quarantine Areas	3,512,321	3,882,012	369,691
Royal Botanic Gardens	819,974	864,738	44,764
	23,797,174	26,117,307	2,320,133

	1971-2 \$	1972-3 \$
(a) Includes Assistance to North Coast Dairying Industry	500,000	230,000
(b) Includes State contribution to Bovine Tuberculosis and Brucellosis Eradication Campaign	640,000	700,000

The amounts provided for assistance to North Coast Dairying Industry (\$230,000), and State contribution to Bovine Tuberculosis and Brucellosis Campaign (\$700,000) were transferred to Special Deposits Account, details of which are given later.

GENERAL LOAN ACCOUNT EXPENDITURE 1972-3

Advanced Education—	\$
Capital works financed from State and Commonwealth contributions (State contribution)	900,000
Condobolin Agricultural Research Station —	
Cottages	13,246
Laboratory and administration building	346
Glenfield Veterinary Research Station —	
Administrative building	2,800
Laboratory and conference room	8,532
Griffith Viticultural Research Station —	
Cottage	17,500
Experimental winery	11,018
Narara Horticultural Research Station —	
Screenhouse for strawberry certification	7,477
Narrabri Agricultural Research Station —	
Administration and laboratory building	93,694
Machinery shed	5,400
Orchard shed	1,368
Royal Botanic Gardens —	
Exhibition glasshouse	25,482
Rydalmere Biological and Chemical Research Institute —	
Cotton testing laboratory	1,946
Insect culturing house	12,600
Plant quarantine station	12,778
Seven Hills Poultry Research Station —	
Controlled environment houses	9,464
Tamworth Agricultural Research Station —	
Cottage at Breeza substation	1,740
Trangie Agricultural Research Station —	
Library building	16,298
New dining room and accommodation block	70,222
Wagga Agricultural College —	
District veterinary laboratory	259,855
Wollongbar Agricultural Research Station —	
Dairy building and bails	36,366
Drainage	410
Yanco Agricultural College and Research Station —	
Glasshouse and controlled environment facilities (rice)	16,458
	<u>\$1,525,000</u>

SPECIAL DEPOSITS ACCOUNTS

Transactions on some of the more significant Special Deposits accounts during the year were:

COMMONWEALTH GRANTS FOR STATE SECONDARY SCHOOLS —
TECHNICAL TRAINING PROJECTS

These funds are made available by the Commonwealth under the States Grants (Technical Training) Acts. Works under the first triennium (1965-6 to 1967-8) were completed at a total cost of \$800,000. Works under the second triennium (1968-9 to 1970-1) have not yet been completed — \$17,598 has yet to be spent. Works under the third triennium, which commenced on 1st July, 1971, are in progress and \$443,972 has been spent to 30th June, 1973. Following are the details of expenditure during the financial year ended 30th June, 1973:

<i>Second Triennium (1968-9 to 1970-1):</i>	\$	\$	\$
Grant received from Commonwealth			1,227,000
Previous expenditure to 30th June, 1972		1,180,885	
Expenditure during 1972-3 —			
<i>Hawkesbury Agricultural College</i>			
Animal husbandry unit	3,231		
Physics laboratory	4,229		
PABX switchboard	125		
<i>Wagga Agricultural College</i>			
Animal and plant science laboratory	19,168		
<i>Yanco Agricultural College</i>			
Accommodation block	1,764	28,517	1,209,402
Balance of funds available to complete second triennium			<u>\$17,598</u>

<i>Third Triennium (1971-2 to 1973-4):</i>	\$	\$	\$
Grant received from Commonwealth			2,170,000
Previous expenditure to 30th June, 1972		66,690	
Expenditure during 1972-3 -			
<i>Hawkesbury Agricultural College</i>			
Student accommodation block	195,496		
Apiary building	13,483		
Equipment and teaching aids	12,369		
<i>Yanco Agricultural College</i>			
Animal demonstration unit	702		
Piggery unit	7,792		
Library building	21,996		
Irrigation engineering teaching laboratory . . .	61,393		
Heating of student block	7,500		
Student laundry services	7,206		
Equipment and teaching aids	2,853		
<i>C. B. Alexander Agricultural College</i>			
Beef cattle feeding yards	3,817		
Equipment and teaching aids	38,372		
<i>All Colleges</i>			
General Planning	4,303	377,282	443,972
Balance of funds available to complete third triennium			<u>\$1,726,028</u>

COMMONWEALTH GRANTS FOR COLLEGES OF ADVANCED EDUCATION

Commonwealth legislation provides for grants towards State expenditure on advanced education for courses of instruction which comply with the conditions laid down in the Commonwealth Acts. These grants are made for three purposes:

- (1) Financing of major capital projects on a \$1 for \$1 basis by the Commonwealth and State.
- (2) Library purposes in the form of a direct grant from the Commonwealth.
- (3) Recurrent Expenditure (running costs). The Commonwealth contributes \$1 for every \$2.85 spent by the State.

Expenditure on the advanced education programmes is summarized as follows:

	\$	\$	\$
(1) Major Capital Works -			
<i>First Triennium</i> 1st January, 1967, to 31st December, 1969 -			
Total expenditure First Triennium			800,930
<i>Second Triennium</i> 1st January, 1970, to 31st December, 1972 -			
Expenditure to 30th June, 1972		2,423,607	
Expenditure 1972-3			
<i>Hawkesbury Agricultural College -</i>			
Residential accommodation	200		
Food technology buildings	172,863		
Poultry technology buildings	21,590		
Student accommodation renovations . . .	45,508		
New administration building	55,358		
Steam heating facilities	3,213		
Sewerage	12,104		
PABX switchboard	401		
Roadworks	16,720		
Electrical reticulation	10,000		
Miscellaneous structures	63,568		
Purchase of equipment	31,269		

	\$	\$	\$
Orange Agricultural College —			
Residential accommodation	291,745		
Administration building	129,066		
Lecture rooms	257,968		
Essential services — water supply, etc. . .	227,943		
Staff residential flats	45,642		
Kitchen and dining room	225,722		
Ancillary buildings	34,356		
Landscaping	5,887		
Roadworks	919		
Cottages (seven)	139,414		
Sporting facilities	33,246		
Fencing	3,467		
Construction of airstrip	60		
Irrigation dam	4,299		
Purchase of equipment	14,617		
Purchase of livestock	6,200		
Wagga Agricultural College —			
Residential accommodation	455		
Student accommodation	37,150		
Extensions dining room and kitchen . .	8,922		
Students union building	17,747		
Animal and plant science laboratories . .	16,269		
Dairy buildings	1,979		
Boiler	19,607		
Roadworks	24,508		
Sewerage and water supply	2,152		
Electrical reticulation	619		
Purchase of equipment	12,111	1,994,864	
Total Second Triennium			4,418,471
Third Triennium 1st January, 1973, to 31st December, 1975 —			
Expenditure 1972–73			
Hawkesbury Agricultural College —			
New administration building	86,085		
Food technology buildings	237,148		
Poultry technology buildings	2,472		
Purchase of equipment	3,944		
Miscellaneous structures	4,008		
Orange Agricultural College —			
Residential accommodation	37,339		
Administration building	49,428		
Lecture rooms	93,789		
Kitchen and dining room	82,296		
Ancillary buildings	12,379		
Landscaping	13,262		
Cottages (seven)	8,005		
Sporting facilities	11,724		
Fencing	1,712		
Construction of airstrip	571		
Purchase of equipment	5,807		
Planning	271		
Wagga Agricultural College —			
Cottage	531		
Electrical reticulation	7,850	658,621	658,621
Total expenditure 1972–3		2,653,485	
Total expenditure to 30th June, 1973 All Trienniums			\$5,878,022
(2) Library Grants —			
Hawkesbury Agricultural College —			
Expenditure to 30th June, 1972	7,480		
Expenditure 1972–3	2,464		9,944
Orange Agricultural College —			
Expenditure to 30th June, 1972	254		
Expenditure 1972–3	2,316		2,570
Wagga Agricultural College —			
Expenditure to 30th June, 1972	8,047		
Expenditure 1972–3	1,946		9,993
			\$22,507
(3) Contribution to Recurrent Expenditure —			
Expenditure by the State on Colleges of Advanced Education during 1972–3 was —			
	\$		
Hawkesbury Agricultural	1,784,757		
Wagga Agricultural College	1,086,672		
Orange Agricultural College	154,085		
	\$3,025,514		

The State is entitled to a contribution of \$1 for every \$2.85 of the above expenditure which wholly qualifies for a grant under the terms of the relevant Commonwealth Act.

SWINE COMPENSATION FUND

Following is a summary of operations on the Swine Compensation Fund for year ended 30th June, 1973:

	\$	\$
Balance in Fund at 1st July, 1972		938,203
Receipts — Interest		83,550
		<u>1,021,753</u>
Payments —		
Stamp Duty refunded	1,453	
Compensation	4,494	
Administration costs	<u>4,455</u>	10,402
Balance in Fund at 30th June, 1973		<u>\$1,011,351</u>

CATTLE COMPENSATION FUND

Balance at 1st July, 1972		1,366,349
Receipts —		
Levy	364,060	
Stamp Duty	226,020	
Interest	<u>74,250</u>	664,330
		<u>2,030,679</u>
Payments —		
Compensation	739,991	
Administration Costs —		
Allowances to Secretaries of Pasture Protection Boards	8,389	
Department of Agriculture	<u>19,125</u>	767,505
Balance in fund at 30th June, 1973		<u>\$1,263,174</u>

The following statistical information is supplied in connection with the payment of \$739,991 as cattle compensation:

CATTLE COMPENSATION PAYMENTS 1972–3

	Claims			Animals (No.)			Payments * (\$)		
	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total
Tuberculosis	253	97	350	765	105	870	56,426	11,271	67,698
Cancer	7,003	472	7,475	10,809	697	11,506	491,638	52,766	544,405
Actinomycosis	2,118	8	2,126	2,504	8	2,512	93,715	624	94,340
Actinobacillosis	677	15	692	797	17	814	30,129	2,136	32,265
Pleuropneumonia contagiosa	1	..	1	5	..	5	199	..	199
Tick fever	3	..	3	8	..	8	461	..	461
Johne's disease	4	..	4	5	..	5	621	..	621
	10,059	592	10,651	14,893	827	15,720	\$673,192	\$66,798	\$739,991

*Cents have been omitted from individual payments. This accounts for minor discrepancies in the addition of columns when compared with the totals given.

ERADICATION OF BOVINE TUBERCULOSIS AND BRUCELLOSIS — WORKING ACCOUNT

	\$	\$
Balance in fund at 1st July, 1972		31
Income—		
Contributions by New South Wales		400,000
Contributions by Commonwealth		<u>1,214,025</u>
		<u>1,914,056</u>
Expenditure—		
Salaries, wages and associated charges	546,134	
Travelling and vehicle running costs	27,879	
Purchase of plant and motor vehicles	26,971	
Extension of laboratory at Glenfield	16,564	
Rentals of offices	15,081	
Stores and equipment	37,457	
Administration costs	<u>33,855</u>	
Payments to private practitioners —		
For tuberculosis testing	367,595	
For brucellosis testing	<u>323,383</u>	1,394,919
Balance at 30th June, 1973		<u>\$519,137</u>

COMMONWEALTH EXTENSION SERVICES GRANT

Expenditure from Commonwealth Extension Services Grant over the previous three years is summarized below:

<i>Item</i>	1970-1	1971-2	1972-3
	\$	\$	\$
Research officers	138,173	193,277	260,535
Extension officers	223,844	265,212	319,317
Field assistants	159,097	187,559	205,861
Technical and laboratory assistants	90,866	96,365	111,173
Research operating costs and service charges	..	55,587	64,939
Extension operating costs and service charges	..	32,425	22,610
Travelling expenses and vehicle operating costs	..	94,930	123,416
Agricultural trainees	23,360	30,673	26,832
Publications	..	20,368	8,798
Library services	19,523	27,252	25,288
Conference and study tours — overseas	23,014	18,059	30,387
Herd recording	71,200	71,200	71,200
Conference and study tours — Australia	10,469	7,919	9,399
In service training	5,335	14,238	16,314
Post graduate training — short external courses	15,975	12,292	29,005
Equipment and materials	83,694	10,695	59,068
Extension aids	20,738	18,787	16,539
Motor vehicles	49,876	6,715	3,599
Capital items — major equipment	..	82,328	99,821
Buildings and other major developments	175,688	100,586	142,654
	<u>\$1,110,852</u>	<u>\$1,346,467</u>	<u>\$1,646,755</u>

ASSISTANCE TO NORTH COAST DAIRY INDUSTRY FEED YEAR SCHEME

A feed year scheme, to run for 5 years, was introduced on 1st October, 1966. The scheme was extended, on a restricted basis, for a further three years.

A summary of expenditure is given below:

	\$
1st Scheme year — commencing 1st October, 1966	1,018,960*
2nd Scheme year — commencing 1st October, 1967	650,317
3rd Scheme year — commencing 1st October, 1968	599,410
4th Scheme year — commencing 1st October, 1969	524,215
5th Scheme year — commencing 1st October, 1970	478,375
6th Scheme year — commencing 1st October, 1971	311,847
7th Scheme year — commencing 1st October, 1972	10,491
Total costs to 30th June, 1973	<u>\$3,593,615</u>

*Includes an amount of \$371,945 for initial pasture establishment costs which occurred in the first scheme year only.

NOXIOUS INSECTS DESTRUCTION ACCOUNT

The Noxious Insects Act provides for the striking and collection of a levy under certain specified conditions. Moneys received from the levy are paid into a Special Deposits Account and applied by the Minister for the purposes of the Act.

Following is a financial statement of the operations on this account during 1972-3:

	\$	\$
Balance at 1st July, 1972		301,872
Receipts —		
Levies	285,847	
Sales of motor vehicles and transceivers	<u>2,290</u>	<u>288,137</u>
		590,009
Payments —		
Contribution to Australian Locust Patrol Service	10,500	
Helicopter and aircraft hire	31,298	
Insecticide	54,818	
Travelling expenses (Departmental)	3,020	
Overtime (Departmental)	7,076	
Payroll tax	1,656	
Materials and sundry purchases	6,053	
Purchase of motor vehicle	1,750	
Pasture Protection Board — expenses	<u>1,282</u>	<u>117,453</u>
Balance at 30th June, 1973		<u>\$472,556</u>

A Treasury advance of \$250,000 received in 1969-70 has not yet been repaid, so the true balance at 30th June, 1973, is \$222,556 only.

AUSTRALIAN INOCULANTS RESEARCH AND CONTROL SERVICE — WORKING ACCOUNT

Following is a statement of receipts and payments for the above account for the year ended 30th June, 1973:

	\$	\$
Balance at 1st July, 1972		543
Receipts —		
Contributions from —		
New South Wales	11,260	
Victoria	4,380	
Queensland	5,130	
South Australia	3,375	
Western Australia	9,380	
Tasmania	2,125	35,650
		<u>36,193</u>
Payments —		
Salaries	19,143	
Travelling expenses	547	
Operating expenses	2,022	
Equipment	535	
Buildings — Growth Room	7,788	30,035
		<u>30,035</u>
Balance in account at 30th June, 1973		<u>\$5,158</u>

MISCELLANEOUS ACCOUNTS

VETERINARY SURGEONS ACT

This Act provides for the establishment of a Board of Veterinary Surgeons of New South Wales. Fees and penalties collected are paid to the credit of Consolidated Revenue Fund from which the administrative expenses of the Board are met.

Below is a statement of receipts and payments for the year ended 30th June, 1973:

Receipts	Payments
\$	\$
Registration fees 627	Salaries 2,776
Roll fees 6,095	Members Fees 690
Restoration fees 140	Travelling expenses 11
Examination fees 270	Postal expenses 400
Complaint 10	Examination fees 225
	Printing and stationery 1,543
	Crown solicitors expenses (complaint) 90
	Witness expenses 16
	Excess of receipts over payments 1,391
<u>\$7,142</u>	<u>\$7,142</u>

MEAT INSPECTION SERVICE

The Meat Inspection Service is administered by virtue of the Meat Industry Act, which makes provision for a scale of fees.

Following is a statement of receipts and costs in connection with this service for the year ended 30th June, 1973:

	\$	\$
Receipts from inspection fees		2,294,330
Less charges —		
Salaries, wages and associated items	2,039,575	
Travelling and motor running expenses	112,131	
General stores, freight and cartage	8,769	
Books and periodicals and printing	662	
Rent, electricity, 'phone and postage	2,991	
Sundry expenses	311	2,164,439
		<u>2,164,439</u>
Net gain on Meat Inspection Service		<u>\$129,891</u>

FUND CREATED BY THE WHEAT MARKETING (BARRING OF CLAIMS) ACT 1929

<i>Revenue Account for the year ended 30th June, 1973</i>	\$
Interest on investments (including savings bank interest)	5,479
Less Commitments entered into during the year	5,400
Balance transferred to Farrer Memorial Trust Fund	<u>\$79</u>

Balance Sheet as at 30th June, 1973

Liabilities		Assets	
	\$		\$
<i>Accumulated Funds –</i>			
Balance at 1st July, 1972	104,384	Investment in government securities (face value)	103,000
<i>Add –</i>		Bank – Commonwealth Savings Bank	2,642
Commitments previous years not required	533	Interest – accrued but not received at 30th June, 1973	1,026
Commitments at 30th June, 1973 . .	1,751		
	<u>\$106,668</u>		<u>\$106,668</u>

DAIRY PRODUCTS FACTORY – HAWKESBURY AGRICULTURAL COLLEGE

The operations of the Dairy Products Factory for the year ended 30th June, 1973, resulted in a net loss of \$41,857. Losses over previous years have been:

	\$
1971–2	35,087
1970–1	60,547
1969–70	29,262
1968–9	41,932
1967–8	27,450
1966–7	28,778

Details of operations are as follows:

Manufacturing and Trading Account for year ended 30th June, 1973

	\$		\$
Stock on hand–1st July, 1972	15,516	Sales	440,720
Purchases	348,144	Stock on hand–30th June, 1973	15,652
Salaries and Wages	49,637	Gross Loss	1,060
Depreciation	19,697		
Fuel, light, power	10,194		
Repairs and maintenance	10,603		
Water charges	3,641		
	<u>\$457,432</u>		<u>\$457,432</u>

Profit and Loss Account for year ended 30th June, 1973

	\$		\$
Gross Loss	1,060	Net loss for 1972–3	41,857
Salaries, wages and associated charges	19,199		
Depreciation	948		
Levies	511		
Sundry expenses	2,343		
Interest on capital	17,796		
	<u>\$41,857</u>		<u>\$41,857</u>

STATEMENT OF RECEIPTS – CONSOLIDATED REVENUE FUND

Year ended 30th June, 1973

	\$	\$
<i>Receipts for Services Rendered –</i>		
Rents	95,271	
Students fees	385,251	
<i>Fees –</i>		
Examinations	234	
Witnesses and jurors	206	
Apiary registration	5,260	
Dairy Industry	798	
Farm produce agents	596	
<i>Fertilisers Act</i>	1,228	
Pest Destroyers Act	3,015	
Poultry Processing Act	1,170	
Stock brands registrations	9,294	
Stock Foods and Medicines Act	8,874	
Swine brand registrations	402	
Veterinary Surgeons Act	7,142	
<i>Contributions from Commonwealth –</i>		
For administration of plant quarantine	582,434	
For administration of animal quarantine	215,960	
For administration of Commerce Act	66,618	
For maintenance of gardens at Admiralty House	11,582	
From CSIRO for vegetable growing	1,000	
From CSIRO for cotton research	14,585	
<i>Fees –</i>		
Inspection – Plant Diseases Act	627	
Inspection – Meat Industries Act	2,294,330	
Herd recording	227,103	
Seed certification and testing	16,718	
Miscellaneous	42,244	
A.D.P. Service Bureau charges	2,161	
Administration costs – Cattle Compensation Fund	19,096	
Administration costs – Swine Compensation Fund	4,455	
Commission on premiums collected	10,582	
Miscellaneous receipts for services rendered	57,898	
Total receipts for services rendered		4,086,134
<i>General Miscellaneous Receipts –</i>		
Rents (excluding land, buildings and premises)	14,034	
Fines and forfeitures (including bond liabilities)	14,768	
Interest	862	
Sale of farm produce and livestock	689,706	
Sale of government property	33,569	
Contribution by Commonwealth for Cattle Tick Control	484,022	
Repayments to credit of previous years votes	221,142	
Transfers of part balances of special deposit accounts no longer required	1,763	
Miscellaneous unclassified receipts	2,422	
Pastures Protection Boards – 3 per cent contribution	81,574	
Employers liability to State Superannuation Fund	265,897	
Commonwealth Grant – herd recording	71,200	
Commonwealth Payments – advanced education – recurrent expenditure	1,070,455	
Total – miscellaneous receipts		2,951,414
TOTAL – ALL RECEIPTS		\$7,037,548

APPENDIX II

PUBLICATIONS 1972-3

The publications listed have been classified as: Department of Agriculture (D. of A.) bulletins, booklets, leaflets; contributions to journals, including the Department's journals – the *Agricultural Gazette of New South Wales*, the *Review of Marketing and Agricultural Economics*, *Dairy Topics*, *Poultry Notes*, and *Veterinary Notes* – as well as journals of other organizations; papers presented at technical conferences for which there are published records; theses presented for higher degrees; and miscellaneous articles such as those appearing in industry journals.

The appendix does not list the much greater volume of items published as news and information releases for press, radio and television, newspaper supplements and regional newsletters.

DIVISION OF EXTENSION SERVICES

D. of A. Bulletins, Booklets, Leaflets

Anon. (1973) Small area farming. *Dept Agric. Bull.* Goulburn

Contributions to Journals

Cornelia, Elizabeth (1972).Lame and Slobbering. *Agric. Gaz. N.S.W.* 83: 350.

Cornelia, Elizabeth (1972).National Scheme for Recording Beef Cattle Performance. *Agric. Gaz. N.S.W.* 83: 201.

Cornelia, Elizabeth (1972).Women in Agriculture. *Agric. Gaz. N.S.W.* 83: 279, 365. 84: 45, 117.

Goodrick, Philippa (1973). Women in Agriculture. *Agric. Gaz. N.S.W.* 84: 117.

Simpson, P. C. and Dellow, J. J.(1972). Pasture fertilizer trials in the Bathurst district. *Agric. Gaz. N.S.W.* 83: 215.

Contributions to Technical Conferences

Boyle, A. J. (1973). Hobby farms – an invasion into the resources of the extension worker. *Aust. Agric. Ext. Conf.*, Glenormiston 4: 18.

Fardy, D. T. and Potter, J. N. (1973). The audience for government extension services. *Aust. Agric. Ext. Conf.*, Glenormiston 4: 2

Gidley, V. N. (1973). Keeping in touch with research. *Aust. Agric. Ext. Conf.*, Glenormiston 3: 10.

Gidley, V. N. (1973). Communication from research to extension. *Aust. Agric. Ext. Conf.*, Glenormiston 3: 8.

Gidley, V. N. (1973). Attitudes and perceptions in research/extension liaison. *Aust. Agric. Ext. Conf.*, Glenormiston 3: 13.

Gidley, V. N. (1973). Relevance of agricultural research to extension. *Aust. Agric. Ext. Conf.*, Glenormiston 3: 12.

Gidley, V. N. (1973). Farm record analysis. *Aust. Agric. Ext. Conf.*, Glenormiston 5: 25

Gould, A. H. (1973). Towards effectual printed extension. *Aust. Agric. Ext. Conf.*, Glenormiston 4: 25

Lenne, B. D. and Gordon, M. R. (1973). Comparing needs defined by Agricultural Bureau branches with objectives of extension officers. *Aust. Agric. Ext. Conf.*, Glenormiston 2: 8.

Lenne, B. D. and Elston, J. W. (1973). Giving farmers what they want in farm business management. *Aust. Agric. Ext. Conf.*, Glenormiston 5: 4.

Potter, J. N. (1973). Differences between shires in the use of press and radio by farmers. *Aust. Agric. Ext. Conf.*, Glenormiston 4: 4.

Potter, J. N. (1973). Objectives for extension in farm business management. *Aust. Agric. Ext. Conf.*, Glenormiston 5: 36.

Other Publications

Lees, F. (1972). Last rice pioneer tells her story. *Ricemill News* 10: 2.

DIVISION OF ANIMAL INDUSTRY

D. of A. Bulletins, Booklets, Leaflets

McBarron, E. J. (1972). The nitrate and cyanogenetic status of certain plants in New South Wales. *Dep. Agric. Sci. Bull.* 83.

Contributions to Journals

Ahrens, P. J. (1972). Diseases associated with lot-feeding of cattle. *Agric. Gaz. N.S.W.* 83: 366.

Bayfield, R. F., Saville, D. G. and Falk, R. H. (1973). Vitamin A in the nutrition of sheep. *Agric. Gaz. N.S.W.* 84: 18.

Bell, A. K., Gisz, P. L., and Kelso, H. G. (1973). Successful management of grazing lucerne. *Agric. Gaz. N.S.W.* 84: 136.

Bolla, G. K. and Boyle, A. J. (1972). Lets look outside. *Poultry Notes* October: 2

- Brunskill, A. (1973). Excess fat in prime lamb production. *Agric. Gaz. N.S.W.* 84: 185.
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